DOCUMENT RESUME

ED 144 253 EA 009 969

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TITLE Equalizing Educational Expenditures: A Welfare Analysis of Some Plans for Reform of Spending on Public Education. Final Report.
PUB DATE 31 Jan 75
NOTE 139p.; Not available in paper copy due to light print of original document

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS Educational Demand; Educational Economics; *Educational Finance; Elementary Secondary Education; Enrollment Influences; *Equalization Aid; Expenditure Per Student; *Full State Funding; Low Income Groups; Private Schools; *Public Education; *School District Spending; State School District Relationship; Urban Education; Welfare
IDENTIFIERS Massachusetts

ABSTRACT

The purpose of this study is to examine the gains and losses to different groups in the population if currently prevalent methods of state aid to local public schools are replaced by popular reform plans. Criteria for financing public education are discussed and a method is proposed to analyze suggested reform plans. Data from the state of Massachusetts are then used to estimate a demand for education equation and to estimate the effects of changes in public school expenditures on private school enrollment. In the final section, the estimated equation is used in combination with the standard tools of welfare economics to simulate the effects of variants of three reform plans: full state funding of public schools, power-equalizing, and the modified percentage-equalization state aid plan that is currently the law in Massachusetts. The principal finding of the study is that popular variants of the two reform plans are likely to reduce the economic welfare of most all communities in the state. Evidence also suggests that private school enrollment is not likely to be significantly altered by changes in public school expenditure. (Author/MLF)

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FINAL REPORT

Equalizing Educational Expenditures: A Welfare Analysis of Some Plans for Reform of Spending on Public Education

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January 31, 1975

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Abstract

The purpose of this project was to estimate the net welfare gains and losses to individual communities that may occur if currently prevalent methods of state aid to local public schools are replaced by adopting popular versions of equalizing school finance reform plans. Two specific reform plans are reviewed -- full state financing and pure percentage-equalizing (or power equalizing). The latter plan seeks to eliminate the correlation between public school expenditure and school district wealth by making the net local contribution per dollar of total public school revenue proportional to taxable wealth per pupil.

The principal finding of the study is that popular variants of the two reform plans are likely to reduce the economic welfare of almost all communities in Massachusetts. In general, residents of low-income and urban school districts fare better under a simple foundation plan than under full state funding or power-equalizing.

The methodology used to measure the net welfare gains of the reform plans required estimation of a demand curve for public education, and evidence on the effect of changes in public school financing on private school enrollment. The econometric results indicate that differences in per-student public school expenditure across communities are well explained by differences in community income and in the price of education, where price is defined as the additional dollar of per-student expenditure in the public schools. Econometric evidence also suggests that private school enrollment is not likely to be significantly altered by changes in public school expenditure.

The results do not imply that current methods of school finance are optimal. While proposed automatic formula plans for school finance reform appear to reduce welfare, other plans to increase educational expenditure in low-income communities may have merit.

I. INTRODUCTION

Current methods of financing elementary and secondary education have been increasingly criticized in recent years for their well-documented failure to produce equality in resource inputs to education between different income classes of the population.[1] In a series of important decisions,[2] courts in California, Texas, New Jersey, and Minnesota have ruled that current public financing practices of education in those states are unconstitutional.[3] Although the U.S. Supreme Court, in a 5-4 decision, has overruled the Texas decision, Justice Powell, in his majority opinion, specifically declined to endorse current state practices. Since, in his view, the Texas system does not violate the U.S. Constitution, Powell suggests that remedies be left to the state legislatures rather than the Court.[4] The consequence is that at present states are not required to reform educational finance plans to eliminate

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[1] For example, see Guthrie et al. (1971), Thomas (1968), Coons, Clune and Sugarman (1970), Coons and Sugarman (1971).

[2] *Serrano v. Priest* (1971), *Rodriguez v. San Antonio* (1971), *Van Dusartz v. Hatfield* (1971), *Robinson v. Cahill* (1972).

[3] In the Texas and Minnesota cases, the school finance systems were held to violate the equal protection provision of the Fourteenth Amendment to the U.S. Constitution. The California and New Jersey ruling were based on the constitutions of those states.

[4] See *United States Law Week* (1973).

the correlation between school district expenditures and school district wealth, but are free, through the normal political processes, to adopt such reforms if they wish.[1]

The purpose of this paper is to examine the gains and losses to different groups in the population from several of the more popular reform plans. Criteria for financing public education are discussed and a method is proposed to analyze suggested reform plans. Data from the state of Massachusetts are then used to estimate a demand for education equation and to estimate the effects of changes in public school expenditures on private school enrollment. In the final section, the estimated equation is used in combination with the standard tools of welfare economics to simulate the effects of variants of three reform plans: full state funding of public schools, power-equalizing, and the modified percentage-equalization state aid plan which is currently the law in Massachusetts.

II. CRITERIA FOR FINANCING ELEMENTARY AND SECONDARY EDUCATION

It is technically feasible to supply elementary and secondary schooling in private firms which sell their services to those families willing to pay the price. Public financing of education is generally defended by economists by reference to alleged external economies of education. It is widely believed that a minimum amount of schooling is necessary for survival in modern society. Further, it is claimed that minimum schooling is necessary to provide the common values and communcations skills necessary to make a democratic system

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[1]Since the California and New Jersey decisions are based on state constitutions, legislatures there will be required eventually to replace the current educational finance system.

function effectively. If families do not provide their children with minimum schooling, social harm will result. Since it is not feasible to force individual families to purchase education for their children, compulsory schooling laws combined with public financing of schooling is the result.[1]

As Friedman (1962) and others have argued, public production of educational services is not a necessary companion to public financing of minimum schooling. It is possible to give families vouchers sufficient to purchase the required schooling and to allow them to choose any state-approved institution, public or private.[2] Under present arrangements, parents are allowed to choose private schooling for their children, at the cost of sacrificing the entire amount of the subsidy available in public schools. The result is that private school attendance is mostly composed of children of families wishing to purchase religious education not available in the public schools,[3] with the non-denominational private schools largely limited to children of the upper class.

The provision of schooling in public institutions is frequently justified on income-distribution grounds. Equality of opportunity is an often problaimed social goal. The quality of schooling, by this argument, should not depend on

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[1]For cogent statements of the external economics argument, see Musgrave (1959) and Friedman (1962). Weisbrod (1962) provides quantitative estimates of some of the external benefits of elementary schooling.

[2]For a full discussion of educational voucher proposals, see Center for the Study of Public Policy (1970).

[3]In Massachusetts, 210,967 children attend private elementary and secondary schools. Of these, 174,473 attend parochial schools.

family income. Public schooling, by providing equal resources to all children, promotes social mobility and reduces income inequality in succeeding generations.

In practice, public schooling fails to provide equal resources, since families in most metropolitan areas are faced with a choice of school districts. Families with the financial ability and desire to purchase expensive schooling for their children can locate in a community with better public schools, which they pay for either through higher tax rates or higher housing prices. Exclusive suburban school districts can be viewed as quasi-private schools, which admit those families willing to pay the entry price of purchasing (or renting) a home in the district. If public schooling is to serve its resource equalization function, then the financial base of school finance must be broadened to include at least the metropolitan area, if not the state or federal government. Since states have the primary responsibility for financing education, reformers have looked to state governments to develop fiscal plans to assure that the income-distribution effects of public schools are not reversed by mobility among local fiscal units.[1]

In short, the arguments that a government institution should have a role in financing education to supplement the role of the family, are analogous to the arguments that higher units of government (state, federal) should supplement the role of local government. Two separate justifications for state finance are external economies and the need for equity or income redistribution. Let us consider each of these arguments in turn.

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[1]Coons, Clune and Sugarman (1970) have argued that the quality of schooling should not depend on the level of wealth "other than the wealth of the state as a whole."

On the strict grounds of economic efficiency, it is argued that local communities lacking sufficient wealth may spend too little on public education. If a local community fails to prepare its children for a proper citizenship role, then out-migration will damage other communities as well. The provision of a minimum level of education to all, with the minimum defined by contemporary social standards, then becomes the responsibility of all taxpayers in the state. This is the principle behind foundation programs of state aid to localities.[1] Those communities wishing to spend more than the foundation amount by self-taxation are free to do so. Special compensatory aid to communities with disadvantaged and/or handicapped children is justified on the efficiency criteria if extra expenditures are needed and are effective in bringing those children up to minimum standards of achievement. Strict economic efficiency criteria do not require equalization of expenditures.

The equity arguments are more complicated and less amenable to a consensus among writers. Conclusions depend on subjective views on some difficult issues. Are income differences among families morally justified as returns to more productivity and work effort, or are they the results of social rigidities or chance? Do all children have a right to equal educational expenditures, or do families who have worked harder and earned more have a right to purchase better than average education for their children?[2] If equal education

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[1]Foundation plans were originally proposed by Cubberly (1905) and modified by Strayer and Haig (1923). See Benson (1968) for details on foundation plans.

[2]Friedman (1972) criticizes equalization proposals for denying families the right to purchase better education for their children.

is the goal, should it be defined as equal outputs per child, which implies much more investment in the schooling of children of the relatively poor, or as equal expenditures per child?[1] Should compensatory education be the means to promote better opportunity to the children of the poor, or are direct income transfers to poor families less costly and more effective in achieving the same goals?[2] No doubt writers will continue to debate these questions.

Recommended policy proposals must be based on some weighing of efficiency and distribution criteria, as well as on a choice of what financial arrangements are equitable. It is often a practice in economic research to recommend a policy if the benefits to "whomsoever concerned" exceed the costs, on the assumption that costless income transfers can be made to counter any undesirable distributive effect. This principle of "potential Pareto improvement" forms the basis in welfare economics for applied benefit-cost analysis.[3] Since the purpose of suggested reform programs is to improve the distribution of income, at the cost of some inefficiency, ignoring distribution effects would automatically rule out all such plans. The

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[1]Guthrie et al. (1971) and Center for Public Policy (1970) argue that educational finance plans should promote equality of outputs by providing more inputs to the disadvantaged.

[2]Coleman et al. (1966) shows that home background, not school resources, is the main determinant of school performance. The Coleman findings are confirmed in Mosteller and Moynihan (1972). In light of evidence from the Coleman Report, Jencks (1972) claims direct income transfers are superior to compensatory education as a means for equalizing the income distribution.

[3]See Mishan (1971) and Harberger (1971).

author believes that distribution effects are important and should be weighed against efficiency losses. A finance plan which improves the benefit of the poor less in dollar terms than it reduces the benefits of the rich should not necessarily be ruled out on the grounds that direct income transfers are superior. The direct income transfers may never occur. Rather, it is relevant to know how each reform plan, compared to the alternative of a simple foundation plan, affects the welfare of all groups in the society. The reader himself may then judge whether the gains to low income groups, if there are such gains, are of sufficient magnitude to warrant imposing the measured costs on high income groups.

What are the potential gains and losses to low-income groups from the suggested reform plans? All of the reform plans to be considered intend that the children of low-income families receive more school resources than they do under present arrangements.[1] If low-income parents had to purchase the resources at their supply cost, the additional expenditures would not occur. However, state-wide financing through ability-to-pay taxes of schooling, and any other publicly financed service, makes the price per unit relatively higher for wealthier families. Low income families then gain if the subjective value to them of the additional resources their children receive exceed the costs borne in higher state taxes.

In this paper a benefit-cost analysis from the viewpoint of every single income group and town of proposed changes in school finance is presented. It is assumed that the alternative to each plan studied is a simple foundation plan, and

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[1]Whether intentions in fact correspond to the likely result is examined in Section V.D.

that the adoption of a new educational finance plan will not alter other tax-transfer programs designed to redistribute income. To provide the raw data for the study, we estimate in Part III a demand for educational expenditures equation, using cross-section data from 143 towns and cities in Massachusetts in 1969 and 1970 to obtain income and price elasticities of educational demand. In Part IV, we examine the effect of private school enrollment on public expenditures. Using the estimated demand curve as a measure of the marginal value to consumers of additional expenditures on education, and assuming that state taxes are proportional to income,[1] the incidence of each proposed plan for all towns and income groups is then estimated in Part V.

It is shown in detail in the following chapters that some of the more popular reform plans will result in a subjective loss of benefit to almost all towns including all of the poorer towns and central cities, and will provide only small gains to lower-middle income groups, and losses to all others, when the population is divided into income classes. Some individuals will experience a gain in welfare, especially those with large families, and losses to wealthy families and towns will generally be greater than losses to the poor. The methodology developed in this study is in theory applicable to analysis of any other proposed plan for reform of school finance.

III. DEMAND FOR EDUCATION IN MASSACHUSETTS

Numerous cross-section studies have examined differences in educational and other public expenditures across states as

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[1]Massachusetts has state sales and income taxes. If the tax structure is regressive, the assumption of proportionality makes reform plans involving higher state spending seem more advantageous to the poor than they are in reality.

functions of economic and demographic variables.[1] This study uses data across towns and cities within a state to estimate the price elasticity of demand for education. The sample is similar to one used in a recent study by Feldstein (1973), although the results are slightly different. Parameters from Feldstein's regressions, and other plausible parameters, are used along with the results estimated below to test the effects of parameter variation on the benefit-cost analysis presented below in Section V. It is hoped that the estimates for Massachusetts are not unrepresentative, since Massachusetts is a large, urbanized state with a major fraction of its population in metropolitan areas.[2]

Expenditure per pupil is used as the measure of educational input purchased. Spending is an imperfect measure if prices of inputs vary across communities and if there are economies or diseconomies of scale, so that the same effective input costs more in communities that are too small or too large. The latter problem was partially alleviated by choosing only towns and cities with population over 10,000 in the sample, and by including in most of the regressions only those communities with separate school systems. To account for input cost differences, variables believed to be correlated with higher cost of selected inputs were entered into preliminary regression equations as independent variables. Among the "cost" variables tested were

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[1]For examples, see Tolley and Olson (1971) and McMahon (1970).

[2]Barlow (1970) estimates a price elasticity of demand of -.34, using data on 52 school districts in Michigan. He defines price as the percentage of taxable property classified as non-industrial. For reasons explained below, Barlow's method may underestimate the absolute value of the price-elasticity.

size, population density, percent of families below the poverty line, and percent of families non-white.[1] None of the above variables have any significant effect on expenditure, holding constant the relevant demand variables, indicating that either input cost differences are insignificantly related to all measureable factors, or that the price elasticity of demand for educational inputs is minus one. Other evidence, presented below, appears to refute the latter possibility. Further, attempts to regress specific inputs on community characteristics gave consistently much poorer results than regressions with expenditure per pupil as the dependent variable.

If expenditure per student is the input, then the price of an input can be defined as the additional cost per capita required to raise one more dollar of expenditure per student. Price differences among communities arise from three sources:

1) In some states (including Massachusetts), the state government gives matching aid, with the matching rate tied to wealth per student of the community. The higher the matching rate, the lower the price to the community of spending an additional dollar on its students.

2) Local property taxes finance most of the local share of education in the United States. The price to a community is lower, the greater the share of property owned by non-residents (commercial and seasonal homes). To the extent

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[1]Some of these variables may also be interpreted as demand variables. In any case, whatever their interpretations, their effects on expenditure were found to be statistically insignificant when added to equations including median family income and wealth per student, as other variables.

that taxes on industry are passed on to consumers, those taxes are borne by consumers in all localities rather than residents of the specific locality imposing the tax. However taxes on commercial enterprises owned by outsiders are shifted to some extent to local residents if the supply of capital to a community is elastic.

3) The ratio of students to population varies across communities. As the student to population ratio rises, the price per capita of providing a higher quality of public education, measured in dollars per student, rises. In Massachusetts, it was found that residential suburbs have a much higher student to population ratio than the central cities. In effect, the unique locational advantages of central cities to young single people and to the aged, all of whom occupy taxpaying property, reduces the cost to families of of increasing the quality of public education.

If perfect immobility among communities is assumed, and if it is further assumed that the local political process reaches a decision on resource allocation representing the mean preferences of residents, then a community demand function can be written which is analogous to the standard demand function for individual consumers:

$$E = E(Y, W, P) \qquad (1)$$

where E is expenditure per student, Y is median family income, W is locally owned wealth per capita, and P is the "price" of a dollar of expenditure. In turn, price can be written as:

$$P = a(1-M)R^{b}B^{c} \qquad (2)$$

where M is the matching rate of state aid, R is the percent of taxable property owned by residents, B is the ratio of public school students to population, and a, b, and c are constants. If there is perfect immobility of individuals and if the supply of capital to every community is totally inelastic with respect to tax rate changes, then b is equal to one, and price varies in proportion to proportional changes in the percentage of property owned by residents. If the supply of non-resident capital is perfectly elastic, then non-residents cannot be taxed; i.e. b is equal to zero, and the R term is eliminated from equation (2). Thus, b is expected to be between zero and one. The closer b is to one the greater is the "exploitability" of non-resident owned property. Similarly, c should also be between zero and one. The value of c will be exactly equal to one if non-users of educational services occupy the same value of housing property (per capita) as users, and if the ratio of families with students to non-users in the population is unaffected by tax rates and expenditure on public schools. In general, we might expect increased school taxes and expenditure, all other things equal, to raise the ratio of students to population, in the same manner that it would raise the ratio of residential to commercial property values.

If we assume a constant elasticity demand function, and insert equation (2) into equation (1), we obtain:

$$E = aY^{d}W^{e}(1-M)^{f}R^{bf}B^{cf} \qquad (3)$$

where d is the income elasticity of educational demand, e is the own wealth elasticity of educational demand and f is the price elasticity of demand ($f < 0$). Note that direct

estimation of (3) by ordinary least squares yields estimates of all the parameters, under the assumption of the same response to any proportional change in price.

The assumption of perfect immobility between communities is highly unrealistic. If mobility between communities exists, estimates of equation (3) are biased. The direction and probable magnitude of this bias in the sample used here are discussed below.

Tiebout (1956) has outlined a model of mobility between communities in which individuals shop around among communities for the optimal combination of public services and taxes suited to their tastes and income. If mobility in the Tiebout sense exists, we should expect that any special advantages of a community, such as favorable location with respect to jobs or a lower price of purchasing public services, would be capitalized in the value of houses. Therefore, the net fiscal advantage would be the same in all communities, and individuals would choose between communities on the basis of differences in personal tastes. Recent empirical work shows that most of the advantage of higher educational expenditures and lower tax rates is indeed capitalized in differences in house prices.[1] If perfect capitalization exists, each individual, contemplating a choice of community, faces the same price of education, where the price of education is the increment in taxes and/or other annual housing costs he must pay to live in a community with higher quality public education.

A model with inter-community mobility is depicted in Figure 1.

Individuals pay for public education through higher housing costs. Figure 1 shows shifts in equilibrium for a single

[1]See, for example, Oates (1969).

community. The line A_oB_o depicts the short-run trade off between educational resources per student and housing costs. With housing values constant, an increase in property taxes raises the funds for increased per-student expenditures. Note that the line intersects the budget line to the right of the origin, since housing costs will be positive even if no funds are allocated to public education. Note also that the horizontal axis measures housing costs for a standard quality house. I_0 and I_1 represent community indifference

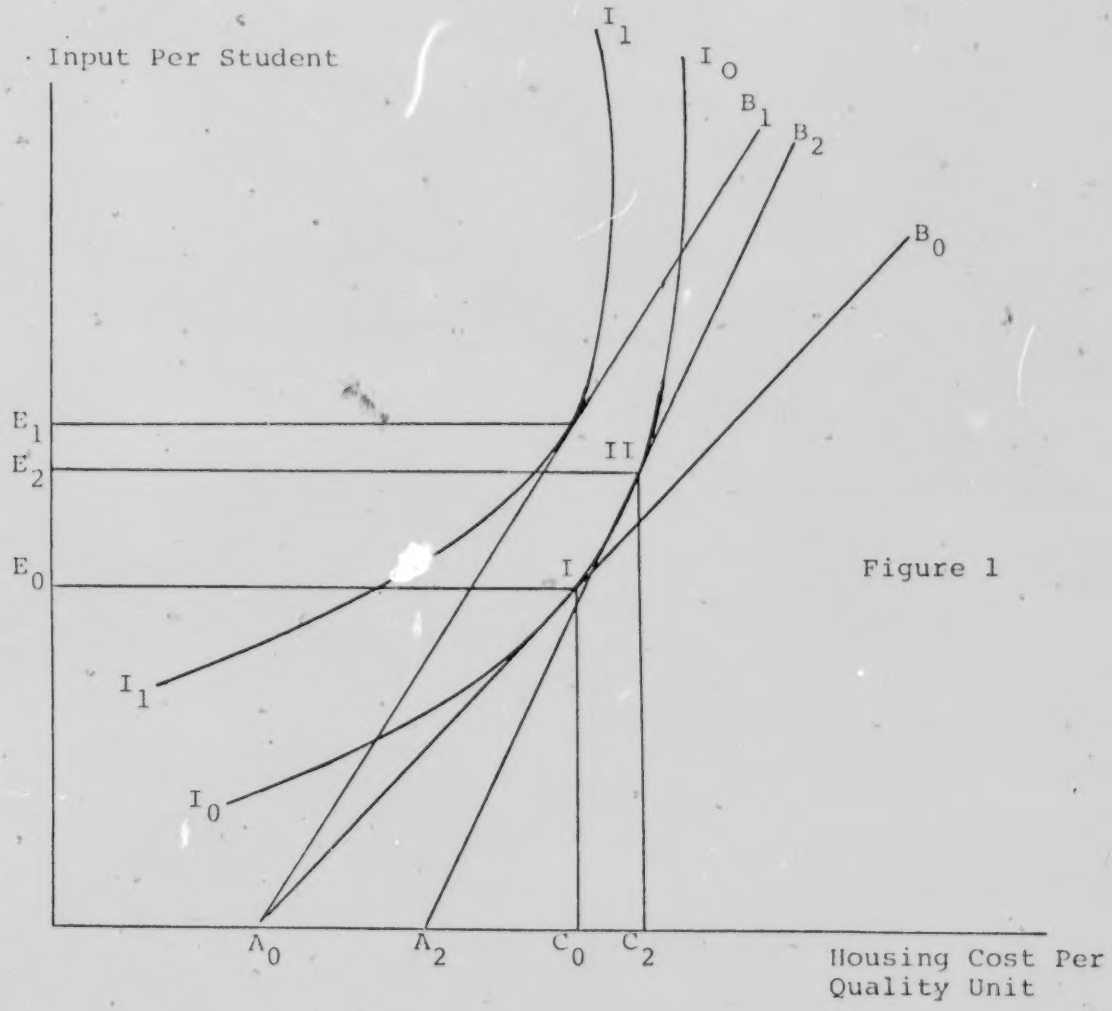

Figure 1

curves. Along each curve, increases in housing cost are compensated by increases in input per student. The slopes of the curve increase as input per student rises, indicating successively greater incremental inputs are required to compensate for additional housing costs. The marginal price of educational inputs is simply the reciprocal of the slope of the budget line, i.e. the change in housing costs divided by the change in input per student.[1]

Now, suppose a new factory moves into the town, increasing the value of non-resident owned property. The resulting fall in the price of education is depicted by a shift in the budget line to A_0B_1, with the new equilibrium along indifference curve I_1. Educational expenditure rises to E_1, while housing cost per quality unit (to the locality) may rise or fall, depending on the price-elasticity of demand for education. Suppose a neighboring town, Town II, exists which is similar in all ways except for the fact that the new industry has located in Town I. The industry shift has made Town I a more desirable place to live. People will attempt to move from Town II to Town I, driving up the value of housing in Town I. Final equilibrium will be at point E_2, where citizens of Town I are on their initial indifference curve.[2]

The relative price of education is still lower in Town I, but residence in Town I no longer is a net advantage. If all individuals in the towns have the same tastes, of if mobility between them does not significantly alter the community utility curves, then the movement from I to II traces out two points of a compensated demand curve for educational expenditure.

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[1] The marginal price is a hedonic price; the price per unit of increased quality. A full discussion of the determination of hedonic prices is given by Rosen (1973).

[2] I am grateful to Martin Feldstein for bringing this problem to my attention.

The problem of bias in estimation of the price-elasticity of demand for education arises if residents have taste differences which are significantly correlated with price differences among towns.[1] Figure 2 depicts a likely long-run equilibrium with taste differences among individuals.

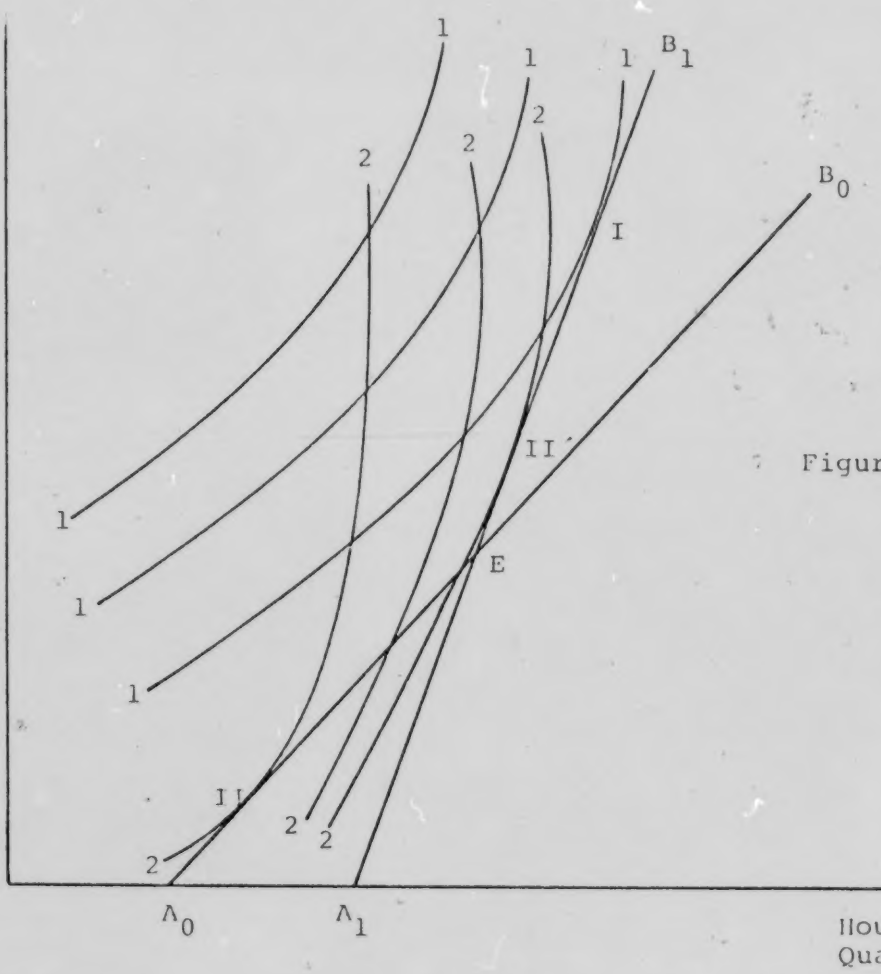

Figure 2

[1]The slope of the final budget line, A_2B_2, is not necessarily parallel to A_0B_1 because the bidding up of housing prices and the change in the composition of the population alters the percent of taxable property locally owned and the student-population ratio.

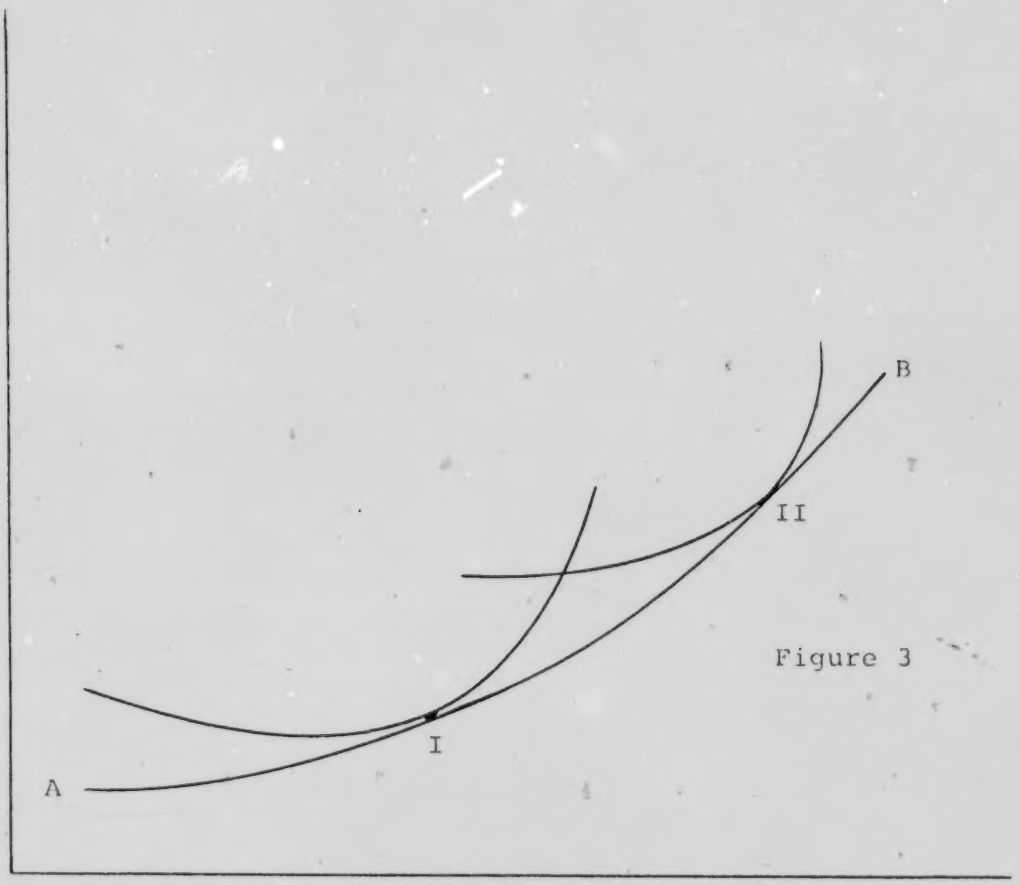

Figure 3

To some extent the shifts in indifference curves can be controlled by including measurable variables about the characteristics of town populations which reflect willingness to spend on education. More formally, if we write:

$$E = f(Y, W, P, T, u) \qquad (4)$$

where T is a vector of 'taste variables" and u is the

residual, the bias results from correlation between unmeasured taste variables included in the residual and price. The correlation between u and p will be smaller the greater the long-run community stability, and the more important factors such as proximity to jobs, ethnic characteristics, and proximity to recreational areas are in locational decisions relative to the housing-cost-school input trade-off.[1] While the correlation between "left-out" taste and price is of course unmeasurable, indirect evidence presented below (see Table 6) indicates reason to believe that shifts in indifference curves among towns are not closely correlated to price.

Massachsuetts is a good state to use for estimating local demand for education because it provides a large, diverse sample of communities, with school district data supplied by the state and town and city data from the U.S. census geographically coterminous. Further, Massachusetts has a complicated state aid formula which provides matching aid to local districts, with the matching rates not perfectly correlated with district characteristics. Matching aid under Chapter 70 of the Massachsuetts laws is given according to the basic formula:

$$A_i = (1 - .65V_i/\bar{V})R_i \qquad (5)$$

where R is reimbursable expenditures in Town i, A_i is state aid under Chapter 70, V_i is equalized property valuation

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[1] If towns were rebuilt every year, and whole communities reshuffled, taste and price would be closely correlated. But if an aging housing stock in central cities attracts low-income residents, price may be lowest in political jurisdictions with the least interest in spending on education. The stability of community ties and the cost of moving may leave most residents' location decision only slightly affected by tax rates and public services. However, it is only necessary for a small fraction of the population to be mobile for prices to adjust as shown in Figure 1. Full capitalization of spending and tax changes in housing prices is fully consistent with a world in which most people don't move.

per school attending child in Town i, and $\bar{V}$ is the property valuation per school attending child in the state. "School attending child" is defined to include pupils in both public and private schools. Under the law, all towns must receive a matching rate of at least 15 percent and no town may receive more than 75 percent. For every town, the matching aid is applied to at least 80 percent, and no more than 110 percent, of the average reimbursable expenditures per public school student in the state. Reimbursable expenditures under Chapter 70 are all current expenditures minus federal aid, categorical state aid, and expenditures related to categorical aid. Until 1972, Chapter 70 aid received in the previous year was subtracted from current expenditures in computing reimbursable expenditures, so that the effective expected matching rate was less than the matching rate implied by direct application of (5).[1] Further, in most years the Massachusetts legislature has not appropriated sufficient funds to meet the schedule provided for in the state aid formula. Aid has been prorated, with each town receiving the same proportion of the aid called for by the formula. Table 1 shows the percent funded from the inception of the NESDEC formula in 1966 through 1973.[2]

Table 1

PRORATING OF NESDEC FORMULA, 1966-1972

Year	Percent Funded
1966	39.5
1967	55.9
1968	70.1
1969	65.0
1970	100.0
1971	100.0
1972	85.4
1973	80.0

[1] Setting $m_i = (1 - .65V_i/\bar{V})$, the state aid formula applied prior to 1972 was $A_i = (m/(1+m))\ R_1$.

[2] The data in Table 1 were supplied to the author by Mrs. Charlotte Ryan.

The curves labelled 1 picture an education-lover, while the curves labelled 2 are indifference curves for an individual with a relatively low taste for education. Note that the education-lover is marked by a relatively flatter indifference curve, indicating a higher marginal valuation of education, at the point where the two curves intersect. A_0B_0 and A_1B_1 are the same community-opportunity lines depicted in Figure 1, with A_0EB_1 representing the opportunity locus facing an individual free to move between the two communities. I and II depict the final equilibrium points of individuals with preference maps 1 and 2, respectively. The individual with the relatively greater preference for education chooses the town with the relatively lower price. If all individuals had indifference map 2, then the point II′ would indicate the expenditure and standardized housing costs in the town marked by the price line A_1B_1. Thus, the grouping of individuals according to taste differences leads to an over-estimate of the price-elasticity of demand for education.

Figure 3 generalizes the argument presented above. The curve AB, an envelope curve of all the individual town price lines for a large metropolitan area in long-run equilibrium, gives the maximum input per student which an individual can purchase for any given per-unit housing cost. The reciprocal of the slope of AB at any point is the marginal price of education in the town associated with that point. The location of individuals along the curve AB depends on their individual indifference curves. A regression of input per student on relative price gives an estimate of the slope of the envelope curve, which is flatter than the slope of any of the individual indifference curves. The absolute magnitude of the price-elasticity is therefore over-estimated.

Before 1970, appropriations were based on 80 percent of the state's tax yield. In 1970, the ceiling was raised to $239 million, with the provision that the ceiling be raised in subsequent years by the percentage rate of growth of sales tax revenue. The sharp decline in percent funded in 1972 is a result of the change in the method of calculating reimbursements discussed above.

The price of an expenditure is reduced by the proportion K, where K is equal to one minus the marginal matching rate of state aid. Since aid for all towns is applied to at least 80 percent and at most 110 percent of average state per student reimbursable expenditures, K is equal to one for towns spending less than 80 percent or more than 110 percent of average expenditures. Small changes in expenditures around either limit can therefore lead to a large change in the marginal price. The percent funded has not been consistent from year to year. Thus, it is sometimes difficult to know for any year the expected value of K, as perceived by local school boards. The problem is exacerbated by the fact that changes in the percent prorated lead to differential changes in desired expenditures in the individual towns and cause large discrete price changes, for those towns pushed within, or outside of, the limits on reimbursable aid. For the two years, 1969 and 1970, 39 out of 143 towns had a value of K equal to one in one year and not in the other.

As a result, estimating the price-elasticity by the coefficient on K involves serious problems of interpretation. In numerous experiments using 1970-71 current expenditures as the dependent variable, the coefficient of K was never found to be negative and significantly different from zero.

On the other hand, using 1969-70 current revenues as the dependent variable yielded a significantly negative coefficient for K, although the size of the coefficient was sensitive to changes in the sample of towns used. Feldstein (1973) uses 1969 current expenditures as a dependent variable, along with a slightly different specification and sample of towns, to estimate the price-elasticity of demand, with the variable defined here as "K" denoted as price. Feldstein's estimates of the price-elasticity range from -0.6 to -1.0, depending on whether promised or actual matching rates are used as the expected rate. My estimates are presented below.

Table 2 defines the variables used in the regressions.

Table 2

VARIABLES USED IN REGRESSIONS

Variable Name	Variable Description	Source
LEXP	Current revenue per student for public education, 1969-70	1
LSHARE	One minus actual marginal matching rate of Chapter 70 Aid, 1969	1
LBURDEN	Ratio of public school students to population, 1969-70	1
MENINC	Mean family income, 1969	2
LFBLOCK	Sum of federal aid per pupil and state categorical aid per pupil, 1969-70	1
LSBLOC2*	Lump-sum component of Chapter 70 Aid	1
SEACAP*	Value of seasonal homes per capita	1
BUSCAP*	Estimated value of business property per capita	1
TAXSTD	Equalized value of real property per public school student, 1970	3

Table 2 (continued)

VARIABLES USED IN REGRESSIONS

Variable Name	Variable Description	Source
PCPRIV	Percent students in public schools	1
EXPRST	Current expenditure per student in public schools, 1970-71	1
MEDINC	Median family income, 1969	2
FBLOCK	Sum of federal aid per pupil and state categorical aid per pupil, 1970-71	1
SBLOCK*	Lump-sum component of Chapter 70 Aid	1
RESASS*	Percent of property residential, 1970	4
GROW	Ratio of 1970 public school students to 1969 public school students	1
LSHAREN	One minus theoretical marginal matching rate of Chapter 70 Aid, assuming full-funding of formula, 1969	1
PRIV	Private school students per capita, 1970	1
BURDEN	Ratio of public school students, 1970-71, to population, 1969	1
PCRES*	Percent of property residential, 1969	2
PCPRO	Percent of residents employed who are classified as professional, technical and kindred, 1969	2
TAXCAP	Equalized value of real property per capita, 1970	3
MEDED	Median school years completed, residents over age 25, 1969	2
RELIEF	Percent of families receiving public assistance, 1969	2
NEGROS	Percent of population Negro, 1969	2

Table 2 (continued)

VARIABLES USED IN REGRESSIONS

Variable Name	Variable Description	Source
MONOPY	Ratio of population of town to population of standard metropolitan statistical area in which it is contained; 1 if not in SMSA, 1969	2
PCRICH	Percent of families with income over $25,000, 1969	2
PCCATH	Percent of families of Irish and Italian origin (immigrants or children of immigrants), 1969	2

*Procedures for computing asterisked variables are described in Appendix I. The variables RESASS and PCRES are from different data, and the variables LSBLOC2 and SBLOCK were computed slightly differently (see Appendix).

Sources: 1) Massachusetts State Department of Education; 2) U.S. Census, State of Massachusetts, 1970; 3) *Boston Globe*, September 14, 1970; 4) Data supplied by Prof. Andre Daniere which was obtained from Governor's Office, State of Massachusetts.

Tables 3, 4 and 5 present estimates of the demand for education, using different samples, different measures of educational input, and different definitions of expected marginal matching aid. In Table 3, 1969-1970 current revenue per pupil is regressed on income, community taste variables, measures of state and federal aid, the public school student to population ratio and the value per capita of business and vacation home property.

Equations (3.1) through (3.3) show that:

1) Community income, price, and outside assistance explain a large fraction of the variance of per-student revenue for public education. The explanatory power of the equation is

especially good when the sample is restricted to the Boston Metropolitan Area, where mobility and the existence of one market area for inputs probably make dollar values a more meaningful measure of differences in input quality.

2) The income elasticity of demand is stable across the subsamples and appears to be between 0.5 and 0.6. Income is a very significant variable in explaining differences in expenditure across communities.

3) Using K (as defined above) as a measure of price produces inconsistent results, although in all three equations the price-elasticity coefficient has the expected sign. On the other hand, LBURDEN, the ratio of students to population has the same coefficient in all three euqations, and is highly significant in each one. A problem in interpreting LBURDEN as an unbiased measure of the price elasticity is that an increase in the student to population ratio has two effects. The economic effect is to raise the costs per capita of an increase in the quality of education as measured by expenditure per student, thereby lowering desired expenditure on education.

Table 3

DEMAND FOR EDUCATION EQUATIONS

Dependent Variable: Revenue per pupil, 1969-70
Method: Ordinary Least Squares
Functional Form: Linear in Logarithms

(t-statistics are in parenthesis)

Equation (3.1): Sample of 130 Towns and Cities in Massachusetts

$$\begin{aligned} LEXP = &-0.9495 - 0.5869\ LSHARE - 0.3415\ LBURDEN + 0.54941\ MENINC \\ &\quad (1.91) \quad (3.69) \qquad (7.01) \qquad (10.36) \\ &+0.1268\ LFBLOCK + 0.01244\ LSBLOC2 + 0.0148\ SEACAP \\ &\quad (5.24) \qquad (2.77) \qquad (3.19) \\ &+0.0417\ BUSCAP + 0.11170\ TAXSTD - 0.044940\ PCPRIV \\ &\quad (3.66) \qquad (3.99) \qquad (2.57) \end{aligned}$$

$R^2 = .6900$, $F(9, 120) = 29.674$

Table 3 (continued)

DEMAND FOR EDUCATION EQUATIONS

Equation (3.2): Sample of 58 Towns and Cities in Boston S.M.S.A.

$$\begin{aligned} LEXP = {} & -0.4770 - 0.3368\ LSHARE - 0.3727\ BURDEN \\ & \quad (0.74) \quad (1.32) \quad (5.64) \\ & +0.5882\ MENINC + 0.0971\ LFBLOCK + 0.0118\ LSBLOC2 \\ & \quad (9.46) \quad (3.04) \quad (1.93) \\ & +0.0050\ SEACAP + 0.0604\ BUSCAP + 0.0242\ TAXSTD \\ & \quad (0.81) \quad (4.21) \quad (0.52) \\ & -0.0471\ PCPRIV \\ & \quad (1.92) \end{aligned}$$

$$R^2 = .8233,\ F(9,\ 48) = 24.847$$

Equation (3.3): Sample of 72 Towns and Cities outside Boston S.M.S.A.

$$\begin{aligned} LEXP = {} & -0.4325 - 0.5923\ LSHARE - 0.3360\ LBURDEN \\ & \quad (0.41) \quad (2.78) \quad (4.73) \\ & +0.5175\ MENINC + 0.1388\ FBLOCK + 0.0074\ SBLOC2 \\ & \quad (5.05) \quad (3.88) \quad (1.12) \\ & +0.1801\ SEACAP + 0.0132\ BUSCAP + 0.1063\ TAXSTD \\ & \quad (2.64) \quad (0.77) \quad (2.74) \\ & -0.0412\ PCPRIV \\ & \quad (1.73) \end{aligned}$$

$$R^2 = .5761,\ F(9,\ 62) = 9.364$$

Table 4

DEMAND FOR EDUCATION EQUATIONS

Dependent Variable: Revenue per pupil, 1969-70
Method: Ordinary Least Squares
Functional Form: Linear in Logarithms

(t-statistics are in parenthesis)

Equation (4.1): 65 Towns in Sample with Highest Mean Family Income

$$\begin{aligned} LEXP = &-0.9953 - 0.4991\ LSHARE - 0.3639\ LBURDEN \\ &(1.32) \quad (1.86) \qquad\qquad (5.28) \\ &+0.62086\ MENINC + 0.15036\ LFBLOCK + 0.011442\ LSBLOC2 \\ &(7.36) \qquad\qquad (2.81) \qquad\qquad (1.61) \\ &+0.0021055\ SEACAP + 0.043668\ BUSCAP + 0.055494\ TAXSTD \\ &(0.29) \qquad\qquad (2.59) \qquad\qquad (1.08) \\ &-0.035650\ PCPRIV \\ &(1.47) \end{aligned}$$

$$R^2 = .7361,\ F(9, 55) = 17.047$$

Equation (4.2): 65 Towns in Sample with Lowest Mean Income

$$\begin{aligned} LEXP = &\ 0.4230 - 0.80754\ LSHARE - 0.32746\ LBURDEN + 0.38550\ MENINC \\ &(0.25) \quad (3.89) \qquad\qquad (3.18) \qquad\qquad (2.20) \\ &+0.10971\ FBLOCK + 0.016207\ SBLOC2 + 0.02183\ SEACAP \\ &(2.99) \qquad\qquad (2.71) \qquad\qquad (3.33) \\ &+0.046515\ BUSCAP + 0.12263\ TAXSTD - 0.069005\ PCPRIV \\ &(2.39) \qquad\qquad (3.62) \qquad\qquad (2.39) \end{aligned}$$

$$R^2 = .6385,\ F(9, 55) = 10.796$$

Table 5

DEMAND FOR EDUCATION EQUATIONS

Dependent Variable: Expenditure per pupil, 1970-71
Method: Ordinary Least Squares
Functional Form: Linear in Logarithms

(t-statistics are in parenthesis)

Equation (5.1a): Sample of 130 Towns and Cities in Massachusetts

EXPRST = -2.124 + 0.10032 TAXSTD - 0.35250 LSHARE
(2.98) (2.89) (1.66)

+0.71460 MEDINC + 0.094754 FBLOCK + 0.021648 SBLOCK
(9.34) (3.25) (1.41)

-0.043637 RESASS - 0.070423 PCPRIV - 0.35872 BURDEN
(0.89) (3.87) (6.35)

-0.51953 GROW
(2.13)

R^2 = .6529, F(9, 120) = 25.079

Equation (5.1b): Sample of 130 Towns and Cities in Massachusetts

EXPRST = -1.321 + 0.019163 TAXSTD + 0.060475 LSHAREN
(1.61) (0.50) (1.72)

+0.74695 MEDINC + 0.12466 FBLOCK - 0.065144 SBLOCK
(10.09) (4.35) (1.76)

-0.044575 RESASS - 0.048011 PRIV - 0.35809 BURDEN
(0.91) (2.52) (6.34)

-0.42735 GROW
(1.72)

R^2 = .6534 F(9, 120) = 25.124

Equation (5.2a): Sample of 58 Towns and Cities in Boston S.M.S.A.

EXPRST = -1.943 + 0.014193 TAXSTD + -0.088648 LSHARE
(1.83) (0.23) (0.26)

+0.79179 MEDINC + 0.055465 FBLOCK + 0.019131 SBLOCK
(6.75) (1.35) (0.86)

-0.11197 RESASS - 0.074686 PRIV - 0.41775 BURDEN
(1.50) (2.76) (4.83)

-0.54277 GROW
(1.52)

R^2 = .7822, F(9, 48) = 19.155

Table 5 (continued)

DEMAND FOR EDUCATION EQUATIONS

Equation (5.2b): Sample of 58 Towns and Cities in Boston S.M.S.A.

EXPRST = -1.228 - 0.034330 TAXSTD + 0.046987 SHAREN
(0.99) (0.52) (0.91)

+0.78907 MEDINC + 0.069995 FBLOCK - 0.033677 SBLOCK
(6.81) (1.70) (0.64)

-0.10230 RESASS - 0.063396 PRIV - 0.40856 BURDEN
(1.38) (2.19) (4.80)

-0.50521 GROW
(1.42)

R^2 = .7856, F(9, 48) = 19.546

Equation (5.3a): Sample of 72 Towns and Cities Outside Boston S.M.S.A

EXPRST = -0.3936 + 0.08200 TAXSTD - 0.31597 LSHARE
(0.27) (1.66) (1.12)

+0.56383 MEDINC + 0.097367 FBLOCK + 0.0077415 SBLOCK
(3.96) (2.25) (0.36)

+0.012452 RESASS - 0.065060 PRIV - 0.28941 BURDEN
(0.18) (2.64) (3.37)

-0.14850 GROW
(0.40)

R^2 = .3471, F(9, 62) = 3.662

Equation (5.3b): Sample of 72 Towns and Cities Outside Boston S.M.S.A.

EXPRST = 0.4851 - 0.0072390 TAXSTD + 0.076973 SHAREN
(0.32) (0.14) (1.62)

+0.60474 MEDINC + 0.13037 FBLOCK - 0.095616 SBLOCK
(4.38) (3.13) (1.90)

+0.0097486 RESASS - 0.038387 PRIV - 0.27920 BURDEN
(0.14) (1.53) (3.27)

-0.029440 GROW
(0.08)

R^2 = .3612, F(9, 62) = 3.894

Table 5 (continued)

DEMAND FOR EDUCATION EQUATIONS

Equation (5.4): Sample of 130 Towns and Cities in Massachusetts, with observations weighted by population and all Chapter 70 Aid treated as if it were lump-sum

$$\begin{aligned} EXPRST = {} & -2.081 - \underset{(2.50)}{0.16870}\ PCRES - \underset{(6.29)}{0.38438}\ BURDEN \\ & + \underset{(10.96)}{0.71451}\ MENINC + \underset{(2.94)}{0.085302}\ FBLOCK + \underset{(1.30)}{0.054104}\ FUND\ 7 \\ & - \underset{(3.19)}{0.061709}\ PCPRIV + \underset{(2.08)}{0.077807}\ TAXCAP + \underset{(0.81)}{0.014891}\ PCPRO \end{aligned}$$

$$R^2 = .6961,\ F(8, 121) = 34.640$$

However, an increase in LBURDEN also is correlated with an increase in the proportion of the voting population with school-age children, which may be accompanied by political pressure for increased expenditure per capita. The coefficient of LBURDEN measures the combination of the price effect and the political effect, and thus under-estimates the absolute magnitude of the price effect taken by itself. If political interest and activity is greatest among families and permanent residents, and if individuals without pupils in the public schools are also interested in school spending to maintain the value of their property, then it is possible that the bias in interpreting LBURDEN as a price coefficient is small.

4) Both Federal Block Aid and State Block Aid have positive coefficients. LFBLOCK is defined as the sum of federal aid and conditional state aid for special programs. LFBLOCK is in general distributed randomly with respect to community income and expenditure. The elasticity of .1268 attached to LFBLOCK in equation (3.1) is consistent with a slope at the means of

1.07, implying that expenditure is increased by approximately the exact amount of the increase in conditional aid. LSBLOC2 is the component of Chapter 70 aid which acts as if it were a block grant. For all communities Chapter 70 aid is a product of the matching rate and reimbursable expenditure, where reimbursable expenditure is a minimum of 80 percent of the state average, and a maximum of 110 percent. Thus, for towns spending less than 110 percent of the state average, the aid applied to 80 percent of the state average acts as if it were a lump-sum grant. It is not increased or reduced by marginal changes in local expenditure. If the locality exceeds the limit of reimbursable expenditure, then the entire Chapter 70 aid received is a lump-sum grant. Since LSBLOC2 varies positively with the town's expenditure, the coefficient attached to it is biased upwards. The estimated elasticity of 0.0124 in equation (3.1) is consistent with a slope at the mean observation of 0.082. The smaller slope attached to LSBLOC2 is expected, since Chapter 70 aid is for general expenditure, and is much less than the community is already spending with its local resources. Equation (3.1) indicates that general lump-sum aid is likely to be used mostly for reduction in the local school tax.

5) Expenditure increases with a rise in the amount of taxable property in the district owned by non-residents. The coefficients attached to SEACAP, seasonal property, and BUSCAP, business property are positive. The coefficient attached to SEACAP is insignificant in the Boston Metropolitan Area sample because towns with significant numbers of seasonal homes don't exist there.

Equations (4.1) and (4.2) divide the sample into the top and bottom 65 communities ranked by mean income. The coefficients of the two equations appear similar, especially the coefficient attached to LBURDEN, although the coefficient

of matching state aid is still unstable. Equations (5.1) through (5.3) show the results of using 1970-71 expenditure as the dependent variable with several subsamples. The variable SHAREN is an alternative definition of the price variable which assumes that towns receiving marginal matching aid are acting as if they expect 100 percent funding. Matching aid does not appear to be viewed as a price by most of the communities, if we compare the unstable and insignificant coefficients attached to SHARE and SHAREN with the stable and significant coefficients attached to BURDEN, the other measure of proportional price reduction. In view of the large change in state practices for funding Chapter 70 aid in 1970, it is not surprising if the local school districts were confused.

Equation (5.4) estimates educational expenditure assuming that all Chapter 70 aid in 1970 was perceived by communities as lump-sum aid.

In separate equations in Table 5, two different measures of percent of property owned by local residents are used. The variable labelled PCRES consistently performed better than the variable labelled RESASS. Descriptions of the construction of the two variables, and a possible reason for the superiority of PCRES are discussed in the Appendix. The coefficient attached to PCRES in equation (5.4) is smaller than the price elasticity, as expected.

Table 6 provides some crude, indirect test of the extent to which education-lovers distribute themselves in towns with a lower price of education. The variable PRICE in Table 6 is computed, using equation (2) and regression coefficients from equation (5.4), by the formula:

$$\text{PRICE} = \text{BURDEN} \times (\text{PCRES})^{.16/.38}$$

Table 6

PRICE EQUATIONS

Dependent Variable: Price of Educational Expenditures, estimated from Equation (5.4) and labelled PRICE
Method: Ordinary Least Squares
Functional Form: Linear in Logarithms

All equations are weighted by size of town. All equations use 130 Towns and Cities in Massachusetts as the sample.

(t-statistics are in parenthesis)

Equation (6.1):

$$\underset{}{\text{PRICE}} = \underset{(7.85)}{-9.900} + \underset{(6.39)}{0.85394}\ \text{MENINC}$$

$$R^2 = .2416,\ F(1, 128) = 40.771$$

Equation (6.2):

$$\underset{}{\text{PRICE}} = \underset{(0.71)}{-0.5719} - \underset{(1.58)}{0.12533}\ \text{TAXSTD}$$

$$R^2 = .0192,\ F(1, 128) = 2.503$$

Equation (6.3):

$$\underset{}{\text{PRICE}} = \underset{(7.60)}{-8.860} + \underset{(8.54)}{1.1353}\ \text{MENINC} - \underset{(5.25)}{0.36362}\ \text{TAXSTD}$$

$$R^2 = .3768,\ F(2, 127) = 38.398$$

Equation (6.4):

$$\underset{}{\text{PRICE}} = \underset{(7.23)}{-9.154} + \underset{(3.55)}{0.58891}\ \text{MENINC} + \underset{(2.61)}{0.20533}\ \text{TAXCAP}$$

$$R^2 = .2801,\ F(2, 127) = 24.701$$

Table 6 (continued)

PRICE EQUATIONS

Equation (6.5):

$$\underset{}{PRICE} = \underset{(7.17)}{-10.79} + \underset{(6.09)}{0.93621}\ MENINC - \underset{(1.08)}{0.062345}\ PCPRO$$

$$R^2 = .2485,\ F(2, 127) = 21.000$$

Equation (6.6):

$$PRICE = \underset{(0.12)}{0.1290} - \underset{(1.47)}{0.24341}\ EXPRST$$

$$R^2 = 0.0166,\ F(1, 128) = 2.160$$

Equation (6.1) shows that high income families, in general, appear to locate in towns with high prices, despite the higher marginal evaluation of education among high income communities. Although per-student wealth is negatively correlated with price, per capita wealth is positively correlated with price (Equation (6.4)). Finally, Equation (6.6) estimates the equilibrium curve of Figure 3. The coefficient of EXPRST indicates that the curve is indeed much flatter than the indifference curves estimated by holding some of the demand shift variables (income, percent professional, percent in private schools) constant. However, the correlation between PRICE and EXPRST is very low, indicating considerable imprecision in the relationship. It appears that the perfect mobility hypothesis, which implies a strong, negative relationship between PRICE and EXPRST, is not confirmed.

In short, indirect evidence indicates that the downward bias in estimating the price-elasticity implied by a perfect long-run mobility model with no considerations other than

expenditure per pupil and housing costs affecting individuals' choice of location is not great, although it is not possible to estimate precisely the extent to which left-out taste for education variables are negatively correlated with price. On the other hand, use of the student to population ratio as a measure of price biases the price-elasticity estimate upwards (toward zero). Therefore, it is reasonable to view the coefficient of BURDEN in equation (5.4) as a lower bound of the absolute value of price elasticity.

IV. PRIVATE SCHOOL ENROLLMENT AND PUBLIC POLICY

Current proposals to equalize spending in public schools across communities or to provide systematic compensatory spending, do not suggest any change in an individual family's option to purchase schooling in private institutions meeting state standards. If equalization in public schools results in an exodus to private schools of the children of wealthy families, the major goal of the equalization program will be negated. This section explores the relationship between public expenditure and private school enrollment.

Private school enrollment has two effects on public school expenditure. First, an increase in private school enrollment lowers the proportion of the population with a direct interest in maintaining high quality public schools, leading to a reduction in desired expenditure. Second, an increase in private school enrollment lowers the public school student to population ratio. The resultant fall in the per-capita tax price of public education should lead to an increase in public expenditure per student. If the second effect is greater than the first, increased private school enrollment by the wealthy will

benefit those remaining in public schools in absolute terms by raising public expenditure per student without increasing school taxes, although it will also widen inequality by increasing the dispersion of individual expenditures.

Further, private school enrollment may itself be a function of public school expenditure. If expenditure in public schools is an important determinant of the perceived quality of education, a reduction in public school expenditure may lead to increased enrollment in private schools.

Equations (6) through (8) outline a simple model encompassing the interaction between private school enrollment and public school expenditure.

$$EXPRST = E(BURDEN, PCPRIV, X_1) \quad (6)$$

$$PCPRIV = P(EXPRST, X_2) \quad (7)$$

$$BURDEN = B(PCPRIV, PCSTUD) \quad (8)$$

EXPRST is public school expenditure per student, BURDEN public school students per capita, PCPRIV the percent of students in private schools, PCSTUD the ratio of all students to population, and X_1 and X_2 exogenous vectors of demand shift variables in equations (6) and (7), respectively. Some of the variables in X_1 are mean family income, percent of tax base owned by local residents, federal and state aid per student, and wealth per capita. X_2 might include the proportion of Catholic families, the percent of extremely wealthy families, and the characteristics of most students in the public schools.

Table 7 presents ordinary least squares estimates of equation (7). The percent of students in private schools seems to be determined by demographic characteristics of the population. Since most of the private school population in Massachusetts

attends parochial schools, the percent of Catholics in a town should be an important determinant of total private school enrollment. Direct data on a religious breakdown of the population was unavailable, so the percentage of the population who are immigrants or first generation people of Irish and Italian descent was used as the proxy variable PCCATH. PCCATH has the expected positive sign and is highly significant. A second important source of enrollment in private schools is extremely wealthy families. PCRICH, the percentage of families earning at least $25,000 in 1969, was also found to be positively related to private school enrollment and significant.

The interesting observation about equations (7.1) through (7.3), which are representative of many specifications tested, is that no evidence exists indicating an effect of EXPRST on PCPRIV.[1] Private school enrollment appears unaffected by the level of spending in public schools. However, private school enrollment is higher in communities with more families on welfare and with a lower average level of education in the public schools. This result is consistent with an interpretation that prospective private school users are concerned about the quality of public schools, but are motivated more by quality of the students in public schools than by the amount of resource inputs.

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[1] The coefficient of EXPRST in equations (7.1) through (7.3) is biased downwards if increased private school attendance reduces desired public school attendance. However, estimation of equations (6) through (8) by two-stage least squares yielded qualitatively similar results.

Table 7. Private School Enrollment Equations

Dependent Variable: Percent of Students in Private Schools

Method: Ordinary Least Squares

Functional Form: Linear

All eqs. are weighted by size of town. All eqs. use 130 Towns and Cities in Massachusetts as the sample.

(t-statistics are in parenthesis)

Eq. (7.1):

$$\underset{}{\text{PCPRIV}} = \underset{(6.88)}{1.224} + \underset{(0.71)}{0.0001}\ \text{EXPRST} - \underset{(6.81)}{0.1000}\ \text{MEDED}$$

$$+ \underset{(4.47)}{1.7267}\ \text{RELIEF} + \underset{(2.39)}{0.56717}\ \text{PCRICH} + \underset{(3.75)}{0.66771}\ \text{PCCATH}$$

$$R^2 = .5513 \qquad F(5,124) = 30.471$$

Eq. (7.2):

$$\underset{}{\text{PCPRIV}} = \underset{(6.52)}{1.303} + \underset{(0.64)}{.0001}\ \text{EXPRST} - \underset{(6.65)}{0.1050}\ \text{MEDED} + \underset{(2.75)}{1.4250}\ \text{RELIEF}$$

$$+ \underset{(2.40)}{0.57146}\ \text{PCRICH} + \underset{(3.74)}{0.66598}\ \text{PCCATH} + \underset{(0.87)}{0.0000}\ \text{NEGROS}$$

$$R^2 = .5541 \qquad F(6,123) = 25.471$$

Eq. (7.3):

$$\underset{}{\text{PCPRIV}} = \underset{(6.79)}{1.372} + \underset{(0.46)}{0.0000}\ \text{EXPRST} - \underset{(5.60)}{0.0899}\ \text{MEDED} + \underset{(3.09)}{1.3817}\ \text{RELIEF}$$

$$+ \underset{(2.29)}{1.4659}\ \text{PCRICH} + \underset{(3.93)}{0.70181}\ \text{PCCATH} - \underset{(1.51)}{0.00002}\ \text{MENINC}$$

$$R^2 = .5595 \qquad F(6,123) = 26.037$$

RELIEF, the percentages of families on welfare, may be a measure of the number of students from extremely deprived homes in the public schools, while MEDED, the average level of education of people over 25, may reflect the average intelligence and motivation of the representative public school student. Equation (7.2) indicates that welfare itself, and not its correlation with the number of Negroes, is the important variable, while equation (7.3) suggests that the median education variable is important independent of its correlation with mean family income.

In other words, equations (7.1) through (7.3) suggest that usage of private schools by families who are motivated primarily by dissatisfaction with the low level of expenditures in the public schools is not a statistically important phenomenon. This finding is confirmed by analysis of consumer surplus from consumption of education presented in Section V. It is shown that for plausible values of price and income elasticities of demand, very few families have a high enough income to make private school attendance worthwhile because of insufficient public expenditures alone.

Since private school enrollment is not affected by expenditures, it is simple to compare the two effects of exogenous shifts in PCPRIV on expenditures. The direct elasticity of EXPRST with respect to PCPRIV is estimated in equation (5.4) to be -0.0617. The indirect effect of PCPRIV, through its effect on the price of education, is the product of the elasticity of EXPRST with respect to BURDEN and the elasticity of BURDEN with respect to PCPRIV. The former is estimated at -0.3844 in equation (5.4); the latter was estimated at -0.1760 by estimating the definitional equation (8). The product of the two is 0.067. Thus, it

appears that the two effects of exogenous changes in private school enrollment on public school per-pupil expenditures cancel each other out. Table 8 provides further evidence that private school enrollment does not in total affect public school expenditure by estimating the reduced form equation for expenditure from the system (6) through (8). With the exception of PCRICH, all of the exogenous variables in equations (7.1) through (7.3) which affect PCPRIV have no effect in the reduced form equation for expenditure.

In conclusion, the evidence presented here suggests that equalization plans which cause well-to-do families to leave the public schools are not likely to have much effect on per-pupil expenditure on the students left behind. In addition, it appears likely that changed methods of financing schools are not likely to cause much desertion to private schools. The equations do not yield any solid predictions about attempts, through busing and other means, to promote social class integration in public schools.

V. WELFARE ANALYSIS OF PROPOSED SCHOOL FINANCE PLANS

A. Introduction

In this section, some proposed reform plans are analyzed using applied welfare economics. A benefit-cost analysis of the plans is performed from the viewpoint of different towns and income groups. It is assumed that the alternative to each plan considered is a simple foundation plan in which the state pays to each community funds sufficient to provide a minimum level of education and finances the plan with a statewide tax with an incidence proportional to mean family

Table 8. Reduced Form Equation for EXPRST

Dependent Variable: Current Expenditures per Student, 1970-71

Method: Ordinary Least Squares

Functional Form: Linear in Logarithms

Equation is weighted by size of Town. Sample includes all 130 Towns and Cities in Massachusetts.

(t-statistics are in parenthesis)

Equation (8.1):

$$\begin{aligned} EXPRST = {} & \underset{(0.51)}{0.8474} - \underset{(3.04)}{0.1509}\ PCRES + \underset{(2.64)}{0.4201}\ MENINC + \underset{(2.58)}{0.0745}\ FBLOCK \\ & + \underset{(1.90)}{0.0816}\ FUND\ 7 + \underset{(2.20)}{0.0843}\ TAXCAP + \underset{(0.66)}{0.0119}\ PCPRO \\ & + \underset{(0.40)}{0.0705}\ MEDED + \underset{(0.28)}{0.0081}\ RELIEF + \underset{(2.25)}{0.0860}\ PCRICH \\ & - \underset{(0.38)}{0.0057}\ PCCATH - \underset{(6.13)}{0.37546}\ PCSTUD \end{aligned}$$

$R^2 = .7199 \quad F(11,118) = 27.576$

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income.[1] The state subsidy in the foundation plan is set equal to the current minimum per-pupil expenditure in Massachusetts. The costs to the income group or town of each plan is simply the additional taxes plus change in net foundation plan subsidy associated with the plan. Benefits of educational expenditure can in principle be estimated by trying to enumerate the specific benefits received from educational expenditure, quantifying them and relating incremental benefits statistically to incremental educational expenditure. Unfortunately, current knowledge does not permit a good estimate of benefits in this fashion. The only studies which relate expenditure to school outputs use reading and mathematical test scores and dropout rates as measures of output.[2] Consumption benefits, either in the immediate pleasure of attending a better school, or in future enjoyment of life made possible by increased learning are omitted. Further, translation of incremental gains in test scores to incremental gains in lifetime income, i.e., measuring the monetary value of a

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[1]Many state foundation plans operate in a different manner. The state sets the minimum expenditure level and localities receive the difference between that amount and the amount which can be raised with local tax rate X. X is the rate which, when applied to the wealth of the richest community, produces the foundation level of expenditures. If the statewide revenues are raised by a proportional tax on wealth per student, the incidence of the two plans is the same. However, if statewide taxes are proportional to mean family income the form of the foundation plan assumed here is more favorable to communities with a low-ratio of wealth per student to mean family income. Specifically, the form of the foundation plan assumed here is less disadvantageous to big cities than the alternative.

[2]See, for example, Coleman et al. (1966), Katzman (1967), Burkhead et al. (1967) and Bowles (1970).

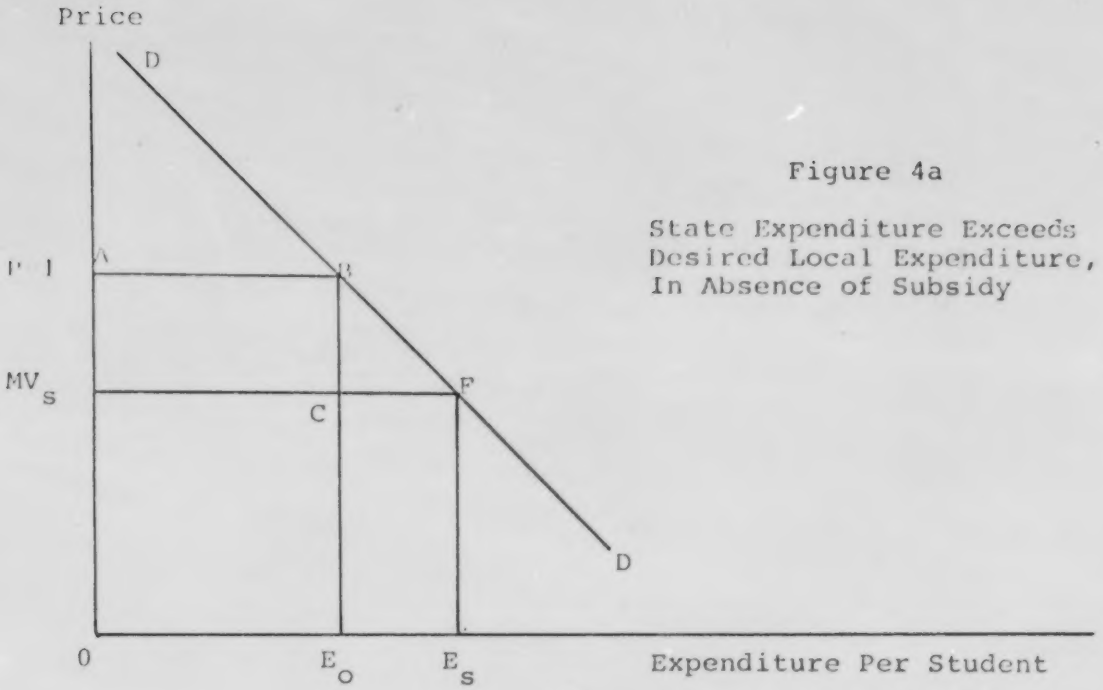

Figure 4a

State Expenditure Exceeds Desired Local Expenditure, In Absence of Subsidy

$$\text{BENEFIT} = OABE_O + BE_OE_SF = E_O + \int_{E_O}^{E_S} P(E)dE \qquad (9a)$$

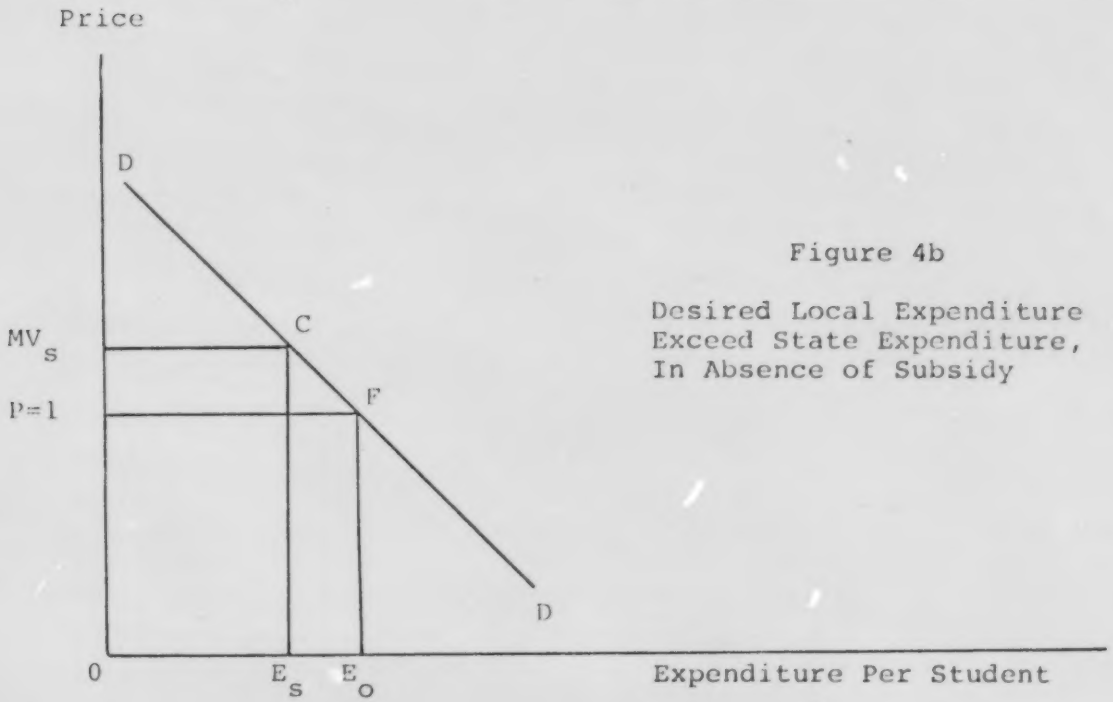

Figure 4b

Desired Local Expenditure Exceed State Expenditure, In Absence of Subsidy

$$\text{BENEFIT} = OABE_S - BCF = OAFE_O - E_SE_OFC = E_O + \int_{E_O}^{E_S} P(E)dE \qquad (9b)$$

test score increment, is not feasible with present knowledge.[1] Therefore, direct enumeration and quantification of benefits is not done. Instead, benefits are measured by assuming that consumers of educational services correctly evaluate the individual benefits to themselves, and that the current system of decentralized school finance enables most consumers to realize their preferences. Benefits are what the buyers perceive them to be.

The assumptions made above require that local finance of education leads to the optimal amount of expenditure. It is assumed that external benefits of education apply only to the minimum spending level which is provided by the foundation plan.[2]

Two general types of aid plans are analyzed. In Plan 1, the state provides all funding, with local or individual supplements to the state subsidy not permitted. The benefits of Plan 1 are pictured in Figures 4a and 4b.

In Figures 4a and 4b, Price is the local residents' share of expenditure per student, E_s is expenditure per student under state financing, E_0 is local expenditure under local financing, assuming no outside subsidies, MV_s is the marginal evaluation of expenditure at spending level E_s and DD is the demand curve for educational expenditure. The total benefit of the state program is the dollar reduction in local costs plus the increased

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[1]Grubb (1971) estimates benefits from elementary and secondary schooling for different income groups by relating years of education to income and adjusting for drop-out rates for pupils from different social classes. However, Grubb's estimates only measure total benefits of educational expenditure; they provide no information on incremental benefits related to incremental expenditures.

[2]My assumption that external benefits apply only to a minimum spending level is also used by Pauly (1967) and Feldstein (1973). If all increments of expenditure have spillover effects, then a system of local finance will lead to too low a level of expenditure.

(decreased) consumer surplus resulting from the increased (decreased) expenditure per student. Note that the benefit in Figure 4b can be negative if the value of consumer surplus loss exceeds the direct value of state assumption of local costs. If the benefit in Figure 4b is negative, the locality or individual would be better-off financing education by itself. In other words, a negative value of benefit, if the program is viewed as public financing for individuals, is equivalent to a situation in which the individual would be willing to sacrifice the public subsidy and purchase the same type of education in the private market.

In Plan 2, the state subsidizes education by sharing the costs with individuals and or towns. The state plan is equivalent to a price reduction. Figure 5 depicts the measurement of benefits under Plan 2.

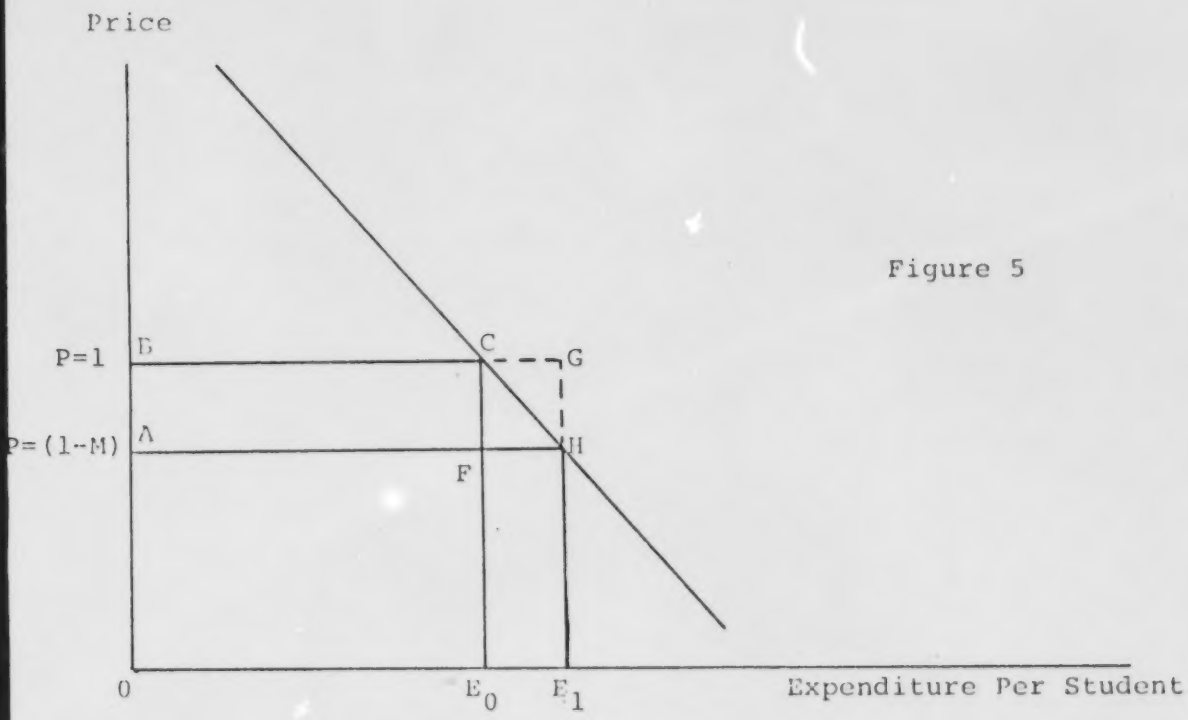

Figure 5

$$\text{BENEFIT} = ABCF + CFH = (OBCE_0 - OAFE_0) + (CE_0E_1H - E_0FHE_1)$$

$$= OBCE_0 - OAHE_1 + CE_0E_1H = E_0 - (1-M)E_1 + \int_{E_0}^{E_1} P(E)dE \quad (10)$$

In Figure 5, OB is the unsubsidized price, while OA is the price after the matching subsidy. The subsidy leads to an increase in expenditure from E_0 to E_1. The benefit is the increase in the area between the demand curve and locally assumed costs, which is the sum of the product of the per-unit subsidy times the original expenditure plus the consumers' marginal net benefit from incremental spending. Note that the area CGH represents the difference between total aid expenditure of the state and the perceived benefit, in equivalent lump-sum dollars, perceived by the locality.

Costs of both types of plans for each locality are calculated by summing the projected increases in state aid over all communities, and then apportioning the share of costs in proportion to the relative mean income and relative student to population ratio of each community.

All the plans considered are composed of either lump-sum grants or price changes, or combinations of the two. A lump-sum grant, which can be added to by the locality, is treated, along with its accompanied change in tax liability as a change in net income, and the expenditure change projected from the estimated income elasticity.

A number of assumptions made here bias the results in favor of the reform plans, especially those that promote more school spending. First, it is assumed that changes in financing arrangements do not affect the unit costs of education. If the teacher supply schedule is upward sloping,[1] if centralization

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[1]Moynihan (1972) argues that the primary effect of reform of school finance will be to raise teachers' salaries. Moynihan's argument implicitly assumes that the supply of teachers is totally inelastic. However, Bean (1973) has shown that teacher supply is quite responsive to wage rate change.

of finance serves as an impetus to future teacher unionization, or if increased state control reduces productive efficiency, the unit costs of quality education may rise. Second, no account is taken of the excess burden of taxation resulting from the increase in state taxes. Finally, assuming proportional incidence of state taxes probably exaggerates the redistributive effect in favor of the poor.

B. Definition of Groups, Mobility Assumptions and Reform Plans

Changes in financial arrangements for funding education will affect both the spending behavior of currently constituted communities and, through changes in residential location, the composition of communities. A full model of the urban economy is required to explain the precise interaction between school expenditure and locational choice. This paper will explore the incidence of reform plans under two alternative mobility assumptions.

Assumption I: There is perfect mobility for all individuals. Location is influenced only by school expenditure and housing costs. Therefore, the price of education is the same for everyone. The only measures of ability to pay for education are average family income and family size. As a first approximation, it is assumed that family size is independent of income. All school aid plans use income, rather than community wealth per student, as the measure of ability to pay. The base plan, to which reform plans are to be compared, is a tuition voucher plan under which all individuals receive an amount per child equal to the 1969-70 expenditure of the lowest-spending community in Massachusetts, and are free to

supplement the voucher with their personal funds to purchase above-minimum quality education. It is assumed that income level is the only source of variation in desired expenditure on education. Using alternative assumptions about the magnitude of income and price elasticities, and setting the expenditure of the mean income family equal to the average educational expenditure per pupil in the state, desired expenditure, in the absence of subsidized prices, is projected for all income groups. Benefits and costs for several proposed programs are then calculated for all income groups, ranging from mean family income of $500 to $50,000 at intervals of $500.

Assumption II: All characteristics of communities will be unaffected by introduction of reform plans for school spending. Therefore, desired expenditure without reform is determined in part by current price differences among communities. All school aid reform plans use equalized wealth per public school pupil as the measure of ability to pay, with the exception of the Massachusetts plan which uses equalized wealth per school attending child. The price of education in each community is projected from equation (5.4). State expenditure, in the base foundation plan, is set at the minimum level for the year 1970-71. Actual expenditure for education in 1970-71 is assumed to be the desired expenditure for education for each community in the absence of a price subsidy from the State. Benefits and costs for the proposed programs are then estimated for all towns. Net gains from the programs (benefits minus costs) are then regressed on community characteristics to examine the differential impact of the programs by income level and degree of urbanization.

The following specific reform plans are considered:

Plan 1a: The state assumes all costs of public education. Any community (family) must sacrifice the entire state subsidy in order to purchase more expensive education. Expenditure is set at the current average level of expenditure per pupil.

Plan 1b: Plan 1b is the same as Plan 1a, except that expenditure is set at the level of the highest-spending town.

Plan 2a: Plan 2a is a version of the power-equalizing plan suggested by Coons, Clune and Sugarman. State aid to localities is given so that the price of education faced by each locality (individual) is proportional to the relevant measure of ability to pay ($P = kA$).[1] If E is expenditure, and S is state aid, then:

$$(E - S)/E = kA \tag{10}$$

Rearranging, state aid can be expressed as:

$$S = (1 - kA)E \tag{11}$$

If $\bar{A}$ is average ability to pay (average income or average wealth per student), (11) can be rewritten as:

$$S = (1 - k_1 A/\bar{A})E \tag{12}$$

The value of k_1 determines the overall subsidy to local spending. The greater k_1, the higher the price faced by all localities (individuals). If k_1 is equal to one, the average locality receives no aid, while poorer localities receive a state subsidy and wealthier localities pay an excise tax on

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[1]Feldstein (1973) shows that the concept of wealth-neutrality, i.e., no correlation between wealth and expenditure, is realized by a power-equalizing plan only if the wealth elasticity of demand is equal to the price elasticity of demand.

education. The problem with an excise tax on education for local communities is that it would encourage individuals to use private schools and make it advantageous for the locality to reduce to a minimum expenditure on public education. While it would be possible to purchase resources at cost in private schools, resources in public schools would be taxed. In practice, many states with percentage equalization plans circumvent this problem by imposing a lower limit on the matching rate implied by equation (12). This practice negates the principle of power-equalizing.[1]

For Plan 2a, the highest feasible value of k_1 is chosen. The value of k_1 is chosen so that public schools will not be more costly to users than private schools using equal resources in any community. Details of calculation of the highest feasible value of k_1 are given in Sections C and D.

Plan 2b: Plan 2b differs from Plan 2a in the choice of the value of k_1. In Plan 2b, k_1 is set equal to $\bar{A}/A_{max}$, where A_{max} is equal to the value of the ability to pay index in the community with the highest mean income or wealth per student, depending on which of these two measures is chosen as the measure of ability to pay. This choice of k_1 makes the price of education equal to unity in the community with the greatest ability to pay, and proportionately less than one in communities with proportionately less ability.

Plan 3: Plan 3 is the current Massachusetts state aid plan. It is assumed that the plan is fully funded over a long period of time, so that localities (individuals) are aware of the prices they face. Under the plan, state aid is equal to:

$$S = mE,\ m = .65\ A/\bar{A} \qquad (13)$$

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[1]Coons, Clune and Sugarman (1970) describe the anti-equalizing effect of the lower-limit on state aid in the Rhode Island percentage equalization formula.

subject to the constraints:

$$.15 \leq m \leq .85 \tag{14}$$

and

$$.80m\bar{E} < S < 1.10m\bar{E} \tag{15}$$

where $\bar{E}$ is average (reimbursable) per pupil expenditure in the state.

Projection of optimal expenditure for individuals and localities in response to the plan is complicated, and is explained in detail in sections C and D.

C. Benefits and Costs of Reform Plans Assuming Perfect Mobility

This section shows the results of the benefit-cost analysis described in Parts A and B, for all of the plans, under the assumption of perfect mobility. The methodology used is described and the results presented separately for each plan.

Plan 1: Desired expenditure for each income group is estimated by the equation:

$$E_d = aY^c \tag{16}$$

where E_d is desired expenditure per student, Y is mean family income, and a and c are constants. Calculations are performed for values of c, the income elasticity of demand, of 0.4, 0.6, and 1.0. The constant "a" is estimated by substituting mean expenditure and mean family income into equation (16). This gives desired expenditure when the price of a dollar of resource inputs is one dollar.

To estimate benefits, the equation $E = aP^bY^c$ is solved for P, the price of an expenditure, to obtain the dollar value

to consumers of an additional dollar spent on education as a function of expenditure.

$$P = a^{-1/b_Y - c/b_E} E^{1/b} \tag{17}$$

Calculations are performed for values of b, the price elasticity of demand, of -0.2, -0.4, -0.6, and -1.0. The two higher estimates of price elasticity represent the range of Feldstein's (1973) estimates, and are included to test the sensitivity of the results presented here to reasonable variations in assumed parameters. Then, benefit is estimated by the formula:

$$BEN = E_d + \int_{E_d}^{E_s} a^{-1/b_Y - c/b_E} E^{1/b} dE \tag{18}$$

In calculations for Plan 1a, E_s is the average per-pupil expenditure in the state. In calculations for Plan 1b, E_s is the per-pupil expenditure in Weston, the wealthiest town.

Costs are estimated by the formula:

$$COST = (Y/\bar{Y})\ E_s + E_{min}\ (1 - Y/\bar{Y}) \tag{19}$$

where $\bar{Y}$ is mean family income in the state, and E_{min} is the expenditure of the poorest town. Thus, costs consist of the sum of the tax liability required to pay for the statewide funding and the net loss (gain) incurred by the elimination of the foundation program.

Tables 9 and 10 show benefits, costs, and net gains for both Plans 1a and 1b, using the best estimates of the price and income elasticities from Part II. Tables 11 and 12 show benefits, costs and net gains using a lower bound on the income elasticity and an upper bound on the price elasticity.

Plan 2a: Before estimating benefits for Plan 2a, it is necessary to choose the highest feasible value of k_1. Then,

Table 9. Benefits and Costs, Plan 1a

State Expenditures per Pupil = 924.34

Price Elasticity = -0.4

Income Elasticity = 0.6

Income	Desired Spending	Benefit	Cost	Net Gain
3,000	387.95	576.26	664.84	- 88.58
5,000	527.09	727.17	718.06	9.11
7,000	645.01	824.36	771.29	53.07
9,000	749.48	884.55	824.51	60.04
10,000	798.92	903.56	851.13	52.43
11,000	845.94	916.15	877.74	38.41
12,000	891.28	922.87	904.35	18.52
13,000	935.23	924.18	930.97	- 6.79
14,000	977.65	920.46	957.58	- 37.12
15,000	1018.97	912.03	984.19	- 72.17
16,000	1059.20	899.16	1010.80	- 111.65
18,000	1136.76	861.05	1064.03	- 202.98
20,000	1210.94	807.72	1117.26	- 309.53
22,000	1282.21	740.46	1170.48	- 430.02
26,000	1417.39	568.06	1276.93	- 708.87
30,000	1544.46	350.25	1383.38	-1033.13
40,000	1835.44	- 364.78	1649.51	-1649.51*
50,000	2098.39	-1287.63	1915.64	-1915.64*

*Net gain cannot exceed cost, since individuals have option of purchasing private education.

Table 10. Benefits and Costs, Plan 1b

State Expenditures per Pupil = 1477.00

Price Elasticity = -0.4

Income Elasticity = 0.6

Income	Desired Spending	Benefit	Cost	Net Gain
3,000	388.0	611.8	794.9	- 183.1
5,000	527.1	803.6	934.8	- 131.2
7,000	645.0	950.9	1074.7	- 123.8
9,000	750.0	1069.1	1214.6	- 145.5
10,000	798.9	1119.7	1284.6	- 164.9
11,000	845.9	1165.5	1354.5	- 189.1
12,000	891.3	1206.9	1424.5	- 217.5
13,000	935.[illegible]	1244.5	1494.4	- 249.[illegible]
14,000	977.6	1278.4	1564.4	- 286.0
15,000	1019.0	1309.0	1634.3	- 325.3
16,000	1059.2	1336.5	1704.3	- 367.8
18,000	1136.8	1382.9	1844.2	- 461.3
20,000	1210.9	1418.9	1984.1	- 565.2
22,000	1282.2	1445.6	2124.0	- 678.4
26,000	1417.4	1474.0	2403.8	- 929.8
30,000	1544.5	1473.1	2683.7	-1210.5
40,000	1835.4	1364.0	3383.2	-2019.2
50,000	2098.4	1128.4	4082.8	-2954.4

Table 11. Benefits and Costs, Plan 1a

State Expenditures per Pupil = 924.34

Price Elasticity = -1.0

Income Elasticity = 0.4

Income	Desired Spending	Benefit	Cost	Net Gain
3,000	518.16	818.07	664.84	153.23
5,000	635.63	873.65	718.06	155.58
7,000	727.20	901.64	771.29	130.35
9,000	804.10	916.16	824.51	91.64
10,000	838.71	920.25	851.13	69.12
11,000	871.31	922.79	877.74	45.05
12,000	902.17	924.07	904.35	19.72
13,000	931.52	924.31	930.97	- 6.65
14,000	959.54	923.68	957.58	- 33.90
15,000	986.39	922.30	984.19	- 61.89
16,000	1012.19	920.29	1010.80	- 90.51
18,000	1061.02	914.70	1064.03	- 149.33
20,000	1106.69	907.43	1117.26	- 209.82
22,000	1149.70	898.86	1170.48	- 271.62
26,000	1229.15	878.84	1276.93	- 398.09
30,000	1301.55	856.12	1383.38	- 527.27
40,000	1460.29	792.49	1649.51	- 857.03
50,000	1596.62	723.96	1915.64	-1191.68

Table 12. Benefits and Costs, Plan 1b

State Expenditures per Pupil = 1477.00

Price Elasticity = -1.0

Income Elasticity = 0.4

Income	Desired Spending	Benefit	Cost	Net Gain
3,000	518.2	1060.9	794.9	266.1
5,000	635.6	1171.6	934.8	236.8
7,000	727.2	1242.5	1074.7	167.8
9,000	804.1	1293.0	1214.6	78.4
10,000	838.7	1313.3	1284.6	28.8
11,000	871.3	1331.2	1354.5	- 23.3
12,000	902.2	1346.9	1424.5	- 77.6
13,000	931.5	1360.9	1494.4	- 133.5
14,000	959.5	1373.4	1564.4	- 191.0
15,000	986.4	1384.6	1634.3	- 249.7
16,000	1012.2	1394.7	1704.3	- 309.6
18,000	1061.0	1412.0	1844.2	- 432.2
20,000	1106.7	1426.1	1984.1	- 558.0
22,000	1149.7	1437.7	2124.0	- 686.3
26,000	1229.1	1454.9	2403.8	- 948.9
30,000	1301.6	1466.1	2683.7	-1217.5
40,000	1460.3	1476.9	3383.2	-1906.3
50,000	1596.6	1472.3	4082.8	-2610.5

having set the price schedule, it is necessary to project changes in expenditure for all income groups, using the estimated parameters of the demand for education equation.

The value of k_1 for Town i that makes price equal to one is $\bar{Y}/Y$, since price is equal to $k_1 Y/\bar{Y}$. However, k_1 may be greater than $\bar{Y}/Y$, without inducing a shift to private schools, for two reasons:

1) The ratio of students to population is greater among the fraction of the population using elementary and secondary schooling than among the population as a whole;

2) Property taxes used to pay for public services are deductible from federal income taxes. Expenditure on private schooling is not tax deductible.

Assuming that the ratio of school age children to people in families divided by the ratio of public school children to population is the appropriate measure of the relative gains to parents of public financing, and using as an estimate of tax deduction for each income bracket the marginal tax rate for a family of four using the standard deduction, a crude estimate of the maximum permissible k_1 for each town was calculated by the formula:

$$k_1 = (RPRIV/RPUB)\ (1/(1-MARTAX))\ (\bar{Y}/Y) \qquad (20)$$

RPRIV is the ratio of school age children to people in families, RPUB is the ratio of public school students to population, and MARTAX is the assumed marginal tax bracket applying to the family income level in question. Assuming no demographic differences among income classes, a value of k_1 was then calculated for the income level corresponding to every town. The minimum of the maximum possible k_1's was then used in the price variable for Plan 2a.

Plan 2b: In Plan 2b, k_1 is simply the ratio of the income in the richest town to state income.

Expenditure will change as a result of Plan 2a because of both price and income effects. The individual's income will be altered both by the subsidy and by the corresponding tax change. The tax change itself is a function of individuals' expenditure responses. For the representative town, the resulting expenditure equation can be written:

$$E = aP^b(Y-(1-P)E)^c \tag{21}$$

where (1-P) is the state matching rate on expenditure. The expenditure for the representative town under Plans 2a and 2b were estimated by nonlinear methods. Then, E was calculated for all individual income levels, with the tax liability at each income level equal to the average tax level multiplied by the ratio of income to mean state income. Using the resulting expenditure predictions, benefit is calculated by:

$$BEN = E_0 - E_1P + \int_{E_0}^{E_1} a^{-1/b_Y - c/b_E - 1/b} dE \tag{22}$$

while cost is equal to:

$$COST = (Y/\bar{Y})\ ((1-P)\bar{E}) + E_{min}(1 - (Y/\bar{Y})) \tag{23}$$

Tables 13 through 16 show gains and losses by income class for Plans 2a and 2b.

Plan 3: Plan 3, the Massachusetts law, is considerably more complicated.[1] Projection of expenditure with a simple logarithmic demand curve is outlined below.

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[1]A more detailed description of the Massachusetts Plan is found in Daniere (1969).

Table 13. Benefits and Costs, Plan 2a

Price = 0.8433 $Y/\bar{Y}$

Price Elasticity = -0.4

Income Elasticity = 0.6

Income	Spending	Benefit	Cost	Net Gain
3,000	735.5	401.6	483.6	- 82.0
5,000	814.6	426.2	416.0	10.2
7,000	871.3	397.8	348.4	49.4
9,000	916.2	334.3	280.7	53.6
10,000	935.8	292.5	246.9	45.6
11,000	953.8	245.0	213.1	31.8
12,000	970.5	192.3	179.3	13.0
13,000	986.2	135.0	145.5	- 10.5
14,000	1000.9	73.5	111.7	- 38.2
15,000	1014.8	8.1	77.9	- 69.9
16,000	1028.0	- 61.0	44.1	- 105.1
18,000	1052.5	- 209.0	- 23.5	- 185.5
20,000	1074.9	- 368.9	- 91.1	- 277.7
22,000	1095.6	- 539.3	- 158.7	- 380.6
26,000	1132.8	- 908.1	- 294.0	- 614.1
30,000	1165.7	-1309.0	- 429.2	- 879.8
40,000	1234.7	-2425.0	- 767.2	-1657.8
50,000	1291.1	-3670.7	-1105.3	-2565.4

Table 14. Benefits and Costs, Plan 2b

Price = Y/Y_{max}

Price Elasticity = -0.4

Income Elasticity = 0.6

Income	Spending	Benefit	Cost	Net Gain
3,000	948.7	486.2	621.6	- 135.4
5,000	1050.8	582.5	646.1	- 63.6
7,000	1123.9	631.7	670.5	- 38.8
9,000	1181.9	650.7	694.9	- 44.3
10,000	1207.1	651.5	707.1	- 55.7
11,000	1230.3	647.4	719.4	- 71.9
12,000	1251.9	639.1	731.6	- 92.5
13,000	1272.1	626.8	743.8	- 117.0
14,000	1291.1	611.0	756.0	- 145.0
15,000	1309.0	592.0	768.2	- 176.2
16,000	1326.0	570.0	780.4	- 210.4
18,000	1357.6	517.8	804.9	- 287.1
20,000	1386.5	455.8	829.3	- 373.4
22,000	1413.2	385.3	853.7	- 468.4
26,000	1461.2	221.8	902.6	- 680.8
30,000	1503.7	32.6	951.4	- 918.9
40,000	1592.7	- 530.4	1073.6	-1603.9
50,000	1665.4	-1194.2	1195.7	-2389.7

Table 15. Benefits and Costs, Plan 2a

Price = 0.8433 $Y/\bar{Y}$

Price Elasticity = -1.0

Income Elasticity = 0.4

Income	Spending	Benefit	Cost	Net Gain
3,000	2597.5	838.1	487.6	350.5
5,000	1911.8	703.4	422.6	280.8
7,000	1562.3	560.0	357.6	202.4
9,000	1343.7	417.2	292.7	124.5
10,000	1261.3	346.8	260.2	86.6
11,000	1191.2	277.2	227.7	49.5
12,000	1130.6	208.5	195.2	13.3
13,000	1077.6	140.7	162.7	- 22.0
14,000	1030.8	73.9	130.3	- 56.4
15,000	989.0	7.9	97.8	- 89.9
16,000	951.4	- 57.2	65.3	-122.6
18,000	886.5	- 185.0	0.3	-185.3
20,000	832.2	- 309.5	- 64.6	-244.9
22,000	785.9	- 431.2	- 129.6	-301.6
26,000	711.9	- 666.3	- 259.5	-406.8
30,000	652.5	- 891.8	- 389.4	-502.4
40,000	549.0	-1420.6	- 714.2	-706.4
50,000	480.2	-1909.5	-1039.1	-870.5

Table 16. Benefits and Costs, Plan 2b

Price = Y/Y_{max}

Price Elasticity = -1.0

Income Elasticity = 0.4

Income	Spending	Benefit	Cost	Net Gain
3,000	5087.3	1204.5	741.0	463.5
5,000	3744.3	1152.9	845.0	307.8
7,000	3059.8	1074.3	949.0	125.2
9,000	2631.6	985.8	1053.1	- 67.3
10,000	2470.3	939.9	1105.1	- 165.2
11,000	2333.0	893.4	1157.4	- 263.7
12,000	2214.4	846.5	1209.1	- 362.6
13,000	2110.5	799.5	1261.1	- 461.6
14,000	2018.7	752.4	1313.1	- 560.7
15,000	1936.9	705.4	1365.1	- 659.7
16,000	1863.3	658.5	1417.1	- 758.6
18,000	1736.2	565.3	1521.1	- 955.8
20,000	1629.8	473.1	1625.1	-1152.1
22,000	1539.2	381.9	1729.2	-1347.3
26,000	1392.4	202.9	1937.2	-1734.2
30,000	1277.9	28.6	2145.2	-2116.6
40,000	1075.3	-388.0	2665.3	-3053.3
50,000	940.5	-780.5	3185.3	-3965.8

For each income group under Plan 3, the price of an expenditure is equal to $0.65\ Y/\bar{Y}$, subject to the restriction that price cannot be greater than .85 or less than .25. Let P_1 denote the price facing an individual who is receiving the marginal subsidy. All individuals spending at least 80 percent of average expenditure and less than 110 percent will face marginal price P_1. For others, the marginal price is 1.0.

Benefits under the plan were computed on the assumption that the society consists of groups of individuals, with the mean income in each group corresponding to the mean income of a town in the sample. Average expenditure is initially set to be equal to projected average expenditure in the absence of the plan. Then, projected expenditure is computed for each group at prices P_1, corresponding to that group and P_0, where P_0 equals one. Letting EP_0 and EP_1 represent expenditures corresponding to P_0 and P_1 respectively, the expenditure projections depend on both EP_0 and EP_1.

Case 1: EP_0 is greater than or equal to $1.10\bar{E}$. The group will spend more than $1.10\bar{E}$ even without the subsidy. Spending is unaffected by the subsidy, $E = EP_0$.

Case 2: EP_0 is less than $1.10\bar{E}$ but greater than or equal to $.80\bar{E}$.

a) If EP_1 is less than $1.10\bar{E}$, $E = EP_1$. The subsidy increases expenditures from EP_0 to EP_1, moving along the demand curve.

b) If EP_1 is equal to or greater than $1.10\bar{E}$, $E = 1.10\bar{E}$. Desired expenditures at the subsidized price exceed $1.10\bar{E}$. But additional expenditures beyond $1.10\bar{E}$ are not matched by the state. Since the marginal value of an incremental dollar on education at $1.10\bar{E}$ is less than one, spending will equal $1.10\bar{E}$.

Case 3: EP_0 is less than $.80\bar{E}$.

a) If EP_1 is less than $.80\bar{E}$, $E = EP_0$. Even with a lower price, expenditures won't be stimulated. Since the lump-sum subsidy on 80 percent of the state average is received whatever the group spends, the subsidy program will not alter expenditures.

b) EP_1 is equal to or greater than $.80\bar{E}$.

Case 3b is depicted in Figure 6.

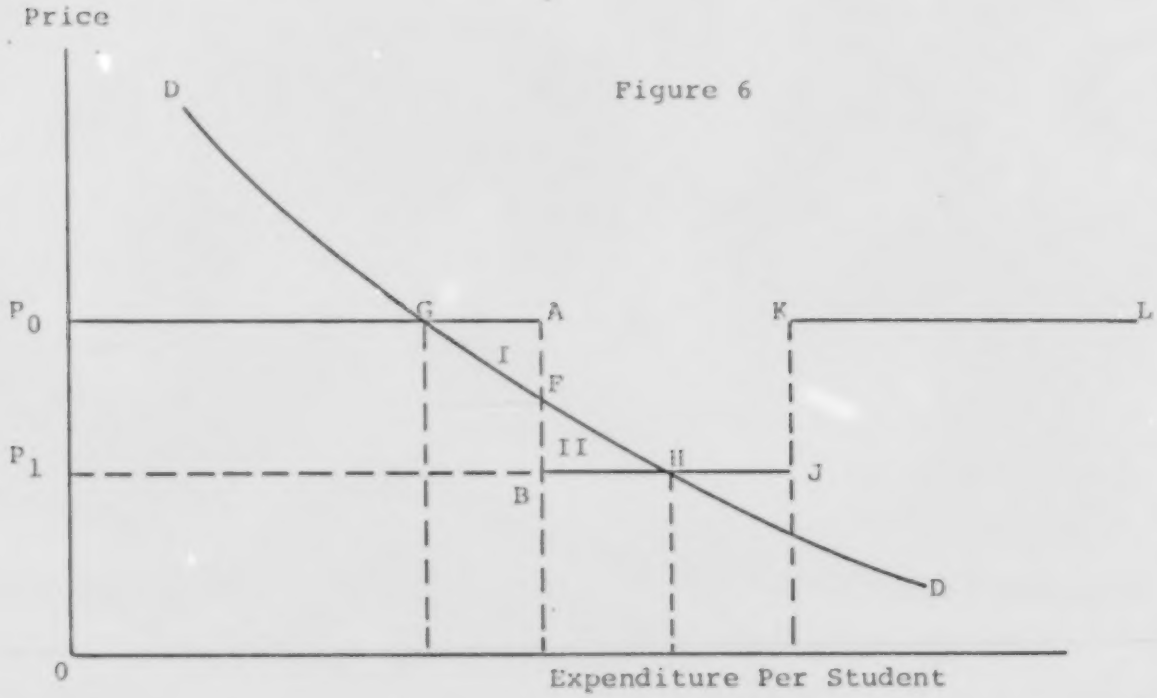

Figure 6

In Figure 6, DD is the marginal evaluation curve for educational expenditure. The marginal price facing consumers is given by the discontinuous set of lines P_0A, BJ, and KL. A shift in consumer expenditure from EP_0 to EP_1 results in a loss in consumer surplus equal to area I, the amount by which price exceeds marginal evaluation to the left of the marginal

price change, and a gain equal to area II, the amount by which marginal evaluation exceeds the subsidized marginal price to the right of $.80\bar{E}$. If area II (triangle BFH) exceeds area I (triangle AGF), utility is maximized at expenditure level EP_1; if not, the optimum expenditure is EP_0. Note that if EP_1 lies to the right of $1.10\bar{E}$, then optimum expenditure is equal to $1.10\bar{E}$.

After estimating expenditure for each group, the corresponding state subsidies are computed. Then, average expenditure and average subsidy per student are computed by taking a weighted average of all the groups. The average subsidy per student is used to compute the tax liability for all groups, while the average expenditure is used to compute a new set of expenditure aid limits. Using the new values of disposable income and expenditure limits, projected expenditure is then recomputed for every group. The results of the 20th iteration appear in the Tables.

Tables 17 and 18 show gains and losses for each income group for Plan 3.

Tables 9 through 18 show mixed results for the different plans. Using the best elasticity assumptions obtained in Part II, both statewide financing (variant 1a) and power-equalizing (variant 2a) redistribute income to the lower-middle part of the income distribution. (The mean income in the sample is 12,751.) Statewide financing has no effect on the mean citizen's fiscal position. Below-average income individuals gain by having the upper-middle groups share in the financing of their schools. Losses to the upper-income groups exceed gains to the lower groups, but ultimate judgment depends on the relative weights the reader wishes to place on gains and losses for different groups. It is conceivable that statewide financing would be found preferable

Table 17. Benefits and Costs, Plan 3

Price Elasticity = -0.4

Income Elasticity = 0.6

Income	Spending	Benefit	Cost	Net Gain
9,032	1037.9	488.3	454.4	33.9
10,191	1056.3	444.6	437.6	7.0
11,005	1068.7	414.8	425.8	- 11.1
12,012	1083.2	378.2	411.3	- 33.1
13,059	1097.6	336.7	396.1	- 59.4
14,004	1110.0	295.9	382.5	- 86.5
15,038	1123.0	248.0	367.5	-119.5
16,389	1139.1	180.6	348.0	-167.3
17,133	1161.0	168.4	337.2	-168.8
18,112	1194.8	174.3	323.0	-148.7
19,221	1194.8	178.4	307.0	-128.6
21,563	1249.4	179.2	273.1	- 93.9
22,938	1296.2	179.2	253.2	- 74.0
23,371	1310.7	179.2	247.0	- 67.8
30,963	1549.9	179.2	137.2	42.0

Table 18. Benefits and Costs, Plan 3

Price Elasticity = -1.0

Income Elasticity = 0.4

Income	Spending	Benefit	Cost	Net Gain
9,032	1516.5	666.0	555.7	110.3
10,191	1516.5	587.3	552.0	35.3
11,005	1516.5	531.7	549.3	- 17.7
12,012	1476.9	461.4	546.1	- 84.7
13,059	1393.8	392.2	542.7	-150.4
14,004	1333.7	331.7	539.6	-207.9
15,038	1275.3	267.2	536.2	-269.0
16,389	1208.3	185.5	531.9	-346.4
17,133	1208.3	169.5	529.5	-359.9
18,112	1235.2	171.9	526.3	-354.4
19,221	1264.6	175.0	522.7	-347.7
21,563	1323.7	182.7	515.1	-332.4
22,938	1356.6	187.3	510.6	-323.4
23,371	1366.7	188.7	509.2	-320.6
30,963	1516.5	211.1	484.6	-273.5

to the foundation plan. On the other hand, if the state spends an amount per pupil equal to the expenditure of the richest district, all income groups, on the average, lose. Power-equalizing also helps the lower-middle section of the population, under the plan in which the price of education is raised to high income individuals. Under variant 2b, where the price is set equal to one for the richest town (income = 30,693) and lowered proportionately for everyone else, the representative individual in every single income class is hurt by the plan (see Table 14). The reason for this result is that the price change raises expenditure for all groups, including the upper middle-class. The additional taxes that the subsidies cause outweigh the gains for everyone. Since it may not be politically feasible to impose an excise tax on spending on education, the outcome suggested by Table 14 is worth careful notice.

The comparison of the two plans appears relatively favorable to statewide financing. However, it should be noted that what is being measured here is based on what appears to be the revealed tastes of a representative citizen in each income group. Since statewide financing, unlike power-equalizing, does not allow citizens any variation in the level of expenditure, it will impose losses on those individuals whose tastes deviate more from the average than other individuals in their income class. Thus, it cannot be stated with confidence that the results favor statewide finance over power-equalizing.

Using alternative income and price elasticity estimates of 0.4 and -1.0 gives more favorable results for both plans. The lower the income elasticity, the smaller is the cost of imposing uniform expenditure on all groups. The

higher the price elasticity, the smaller is the loss under state financing from a distortion of consumer preferences, since education and other goods are better substitutes for each other in the consumers' utility function. Further, the sharp increase in expenditure for low-income groups paying a small tax share gives them much larger benefits for Plan 2 under the alternative elasticity assumptions. However, power-equalizing with the price lowered to all groups still appears a poor plan under the alternative assumptions; it helps the very poor but hurts all income groups earning more than $9,000.

The Massachusetts Plan appears to help the very poor and the very rich and to impose losses on all those in between. The explanation for this apparently odd result is found in the discontinuities in the Massachusetts Plan. Costs are falling with higher income groups because state expenditure under the Plan is less than state expenditure under the assumed alternative Foundation Plan. In the middle range, benefits are falling more rapidly than costs. However, the rate of decline in benefits with respect to income decreases when the lower limit of matching aid is reached and stops completely at the upper limit of reimbursable expenditure. Thus, above $17,000 the relationship between the change in gain and the change in income reverses itself and become positive. The same is true for the relationship below a lower limit. In general, the gains and losses for the Massachusetts plan are moderate relative to the other proposals. The moderation is a direct result of the limits placed on the plan which prevent it from operating as a pure percentage-equalization plan.

Finally, the gross benefit from statewide financing is

always positive under the high price-elasticity assumptions, and is positive for all income less than $35,000 under the assumption that price-elasticity is -.4. In light of the discussion on measuring welfare gains of state expenditures presented in this paper, this means that a family with the average tastes for its income class would not wish to use the public schools under full state financing unless its income exceeded $35,000. In Massachusetts, in 1969, only 5.6 percent of families had an income in excess of $25,000. Thus, the result lends credence to the econometric estimate in Chapter II which indicates that dropouts to private schools as a result of decreased spending on local public education are not likely to be a statistically important phenomenon.

In summary, Tables 9-18 show mixed results for the proposed reform plans. A power-equalizing plan setting price equal to one for the wealthiest group appears to cause net losses to all income classes. The other plans involve considerable redistribution with large losses for upper-middle income groups balanced by small gains to the lower middle class. The magnitude of gains and losses is sensitive to variations in the estimated parameters, although Plans 1b and 2b appear unfavorable for all reasonable values of price and income elasticities. Finally, the evidence shows that equalization of public school spending is not likely to cause large shifts to private schools.

The main defect of the analysis in section C is that aid plans are based on per-student wealth which is not perfectly correlated with family income.

Section D presents less optimistic appraisals of the

reform plans, using data on current wealth, income and demographic composition of Massachusetts communities.

D. Benefits and Costs of Reform Plans with Present Residential Patterns

This section presents estimates of the same plans estimated in part C for towns and cities in Massachusetts. Although the calculations assume perfect immobility, they are not irrelevant to a world where people can move. The first-round gains and losses estimated below should be reflected, in a world of mobility, in housing price changes in the towns and cities. Therefore, residents who are homeowners will receive once and for all gains (or losses) in wealth in accordance with the pattern of welfare changes measured here. However, predicted changes in community expenditure won't be stable if the composition of communities changes.

For the most part estimation of gains and losses is carried out by the same procedures used in section C for each plan. The important methodological differences are:

1) All calculations are based on the demand for education equation estimated in Table 5, equation (5.4).

2) Desired expenditure for each town in the absence of a reform plan is assumed to be equal to actual expenditure. This assumes that towns are currently not reacting to the Massachusetts Plan as if it were permanent. 1970 data, in which no effect of marginal state aid was found, is used in the analysis. Price for each town, in the absence of state aid, is estimated to be the amount paid by local residents. Using the coefficients of eq. (5.4), price is

set equal to (PCRES)(.16/.38). The elasticity of price with respect to the measured percent of property owned by residents is .16 in equation (5.4) if the coefficient of BURDEN is assumed equal to the price elasticity of demand. Then, the town's demand function is written as $E = aP^bY^c$, with "c" the income elasticity of demand in equation (5.4) and "a" solved for by substituting in the above equation the town's values of E, P, and Y. Reform plans, by altering P and Y, then alter E in a predictable way.

3) Matching rates under the power-equalizing plans depend on the ratio $T/\bar{T}$, rather than $Y/\bar{Y}$, where T and $\bar{T}$ are equalized valuation per public school student and average equalization per public school student, respectively. Matching rates under the Massachusetts Plan depend on equalized value per student, public and private.

4) Individual towns' per-student share of the cost of statewide financing are proportional to both relative income and the relative population to public student ratio. This reflects the fact that towns with a relatively low student to population ratio lose from statewide financing, since their residents must pay taxes to support large numbers of students in other districts, while for the same reason towns with a high student to population ratio benefit.

5) Benefits received from lump-sum aid to education for all towns are reduced in proportion to the fraction of initial expenditure already subsidized by outsiders. If the initial price to a town is .9, then the benefit from statewide assumption of costs is .9 multiplied by state spending.

6) For each plan, aggregate net gains are calculated by taking a weighted average of the gains per student in each community.

7) For each town, Federal Aid and Special-Purpose State Aid are subtracted in calculating initial desired expenditures. It is assumed that these programs are for the purpose of special needs and/or special projects in the separate communities and do not alter local expenditure. Further, it is assumed that Federal Aid and Special-Purpose State Aid will be the same under all Plans including the base plan. The analysis here is meant to analyze the effects of plans promoting general redistribution of spending and not to comment on the merit of specific aid designed to meet special needs and/or extraordinary costs. The regressions presented in Table 5 of Part II support the assumption that Federal and Special-Purpose Aid do not affect the level of local general-purpose expenditure.

8) In the Statewide Financing Plans, Federal Aid and Special-Purpose State Aid is also subtracted out in calculating mean and maximum expenditure levels.

9) All benefits, costs, and net gains are listed in per-student terms.

Since income and tax base per student are not closely correlated, programs which subsidize low wealth per student towns do not necessarily help all low-income communities. For each plan, gains are regressed on town characteristics to indicate the extent to which the plans may be redistributive by income class.

Table 19 lists the towns and cities used in the sample. Table 20 shows the gains and losses to each town from Plan 1a.

Table 19. List of Towns in Sample

1. Abington
2. Acton
3. Adams
4. Agawam
5. Amesbury
6. Amherst
7. Andover
8. Arlington
9. Athol
10. Attleboro
11. Auburn
12. Barnstable
13. Bedford
14. Bellingham
15. Belmont
16. Beverly
17. Billerica
18. Boston
19. Bourne
20. Braintree
21. Bridgewater
22. Brockton
23. Brookline
24. Burlinton
25. Cambridge
26. Canton
27. Chelmsford
28. Chelsea
29. Chicopee
30. Clinton
31. Concord
32. Danvers
33. Dartmouth
34. Dedham
35. Dracut
36. Easthampton
37. East Longmeadow
38. Easton
39. Everett
40. Fairhaven
41. Fall River
42. Falmouth
43. Fitchburg
44. Foxborough
45. Framingham
46. Franklin
47 Gardner
48. Gloucester
49. Grafton
50. Greenfield
51. Hanover
52. Harvard
53. Haverhill
54. Hingham
55. Holbrook
56. Holden
57. Holliston
58. Holyoke
59. Hudson
60. Ipswich
61. Lawrence
62. Leominster
63. Lexington
64. Longmeadow
65. Lowell
66. Ludlow
67. Lynn
68. Lynnfield
69. Malden
70. Marblehead
71. Marlborough
72. Marshfield
73. Medford
74. Melrose
75. Methuen
76. Middleborough
77. Milford
78. Millbury
79. Milton
80. Natick
81. Needham
82. New Bedford
83. Newburyport
84. Newton
85. North Adams
86. Northhampton
87. North Andover
88. North Attleborough
89. Northbridge
90. North Reading
91. Norwood
92. Oxford
93. Palmer
94. Peabody
95. Pembroke
96. Pittsfield
97. Plymouth
98. Quincy
99. Randolph
100. Reading
101. Revere
102. Rockland
103. Salem
104. Saugus
105. Scituate
106. Seekonk
107. Sharon
108. Shrewsbury
109. Somerset
110. Somerville
111. Southbridge
112. South Hadley
113. Springfield
114. Stoneham
115. Stoughton
116. Sudbury
117. Swampscott
118. Swansea
119. Taunton
120. Tewksbury
121. Wakefield
122. Walpole
123. Waltham
124. Wareham
125. Watertown
126. Wayland
127. Webster
128. Wellesley
129. Westborough
130. Westfield
131. Westford
132. Weston
133. West Springfield
134. Westwood
135. Weymouth
136. Whitman
137. Wilbraham
138. Wilmington
139. Winchester
140. Winthrop
141. Woburn
142. Worcester
143. Yarmouth

TABLE 20

TOWN	INCOME	DESIRED SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT
1	12480.00	858.99	725.08	729.05	-2.96	0.24	17125.12
2	16399.00	837.54	709.49	735.75	-26.26	0.30	22115.79
3	10191.00	748.00	644.47	749.65	-105.18	0.17	24225.85
4	11428.00	668.74	679.58	735.04	-55.46	0.22	30374.57
5	10409.00	816.78	655.15	744.74	-89.64	0.18	19663.05
6	14004.00	837.36	604.48	873.72	-269.24	0.12	37738.01
7	16585.00	1048.49	651.99	760.81	-108.81	0.25	32983.16
8	13346.00	936.45	748.98	794.42	-45.44	0.17	38985.35
9	10599.00	634.24	546.73	725.60	-178.87	0.21	16529.87
10	12068.00	835.46	579.60	739.22	-159.62	0.21	8992.67
11	12152.00	855.05	729.74	726.50	3.24	0.24	20279.70
12	11304.00	932.16	646.35	718.65	-72.31	0.24	57136.52
13	15424.00	1001.25	611.76	733.81	-122.05	0.28	25029.09
14	11449.00	622.63	668.05	716.95	-48.92	0.24	12555.04
15	17133.00	808.13	751.32	837.27	-85.95	0.17	51193.40
16	12966.00	727.76	679.87	754.29	-74.42	0.21	28084.45
17	11785.00	665.99	701.71	703.42	-1.71	0.29	13140.83
18	10772.00	935.24	553.45	784.29	-230.84	0.14	21246.54
19	9423.00	850.85	490.31	677.59	-187.28	0.32	22736.77
20	13884.00	844.58	679.22	733.35	-54.12	0.26	31074.77
21	11475.00	808.33	700.30	717.30	-17.01	0.25	19159.41
22	11169.00	796.37	666.64	727.17	-60.53	0.22	17708.75
23	18898.00	1470.93	339.66	1022.21	-682.55	0.11	91493.50
24	13422.00	894.13	610.87	703.52	-92.65	0.33	26043.95
25	12013.00	1327.94	355.70	691.89	-525.19	0.10	51133.41
26	15039.00	912.15	692.36	742.94	-70.58	0.22	40037.39
27	14472.00	767.74	739.84	730.77	3.07	0.28	15752.47
28	8632.00	798.78	603.67	751.60	-147.92	0.16	16701.11
29	10528.00	820.63	554.05	741.51	-186.45	0.18	17630.51
30	11005.00	795.13	605.17	787.65	-182.49	0.14	26014.66
31	21582.00	1107.51	653.93	784.74	-130.81	0.28	35770.26
32	12136.00	888.67	711.11	753.07	-41.96	0.21	28146.68

TOWN	INCOME	DESIRED SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT
33	11[illegible]00.00	730.47	717.79	728.65	-10.86	0.22	10[illegible]4.59
34	14[illegible]9[illegible].00	720.79	672.94	752.49	-79.55	0.23	3[illegible]100.75
35	11[illegible]0[illegible].00	7[illegible].11	739.78	723.06	16.72	0.24	16[illegible]3.05
36	11[illegible]5[illegible].00	730.66	656.55	754.05	-98.51	0.18	29[illegible]2.03
37	14[illegible]0[illegible].00	706.75	6[illegible]9.17	743.26	-74.09	0.28	24207.52
38	12[illegible]1.00	7[illegible].38	717.29	712.84	4.45	0.28	19704.38
39	10[illegible]3.00	957.54	627.60	755.74	-128.05	0.17	5[illegible]413.92
40	10298.00	730.55	729.09	731.21	-2.14	0.19	2[illegible]825.42
41	[illegible]050.00	801.42	591.65	764.13	-172.48	0.13	[illegible]805.40
42	11072.00	945.07	590.88	699.16	-108.28	0.28	43534.92
43	10[illegible]0[illegible].00	7[illegible].85	583.96	757.30	-173.[illegible]	0.16	27[illegible]2.43
44	12741.00	951.72	444.27	729.16	-284.89	0.24	22395.89
45	14262.00	864.26	679.10	748.43	-69.33	0.24	29771.04
46	12147.00	913.14	738.57	723.21	15.36	0.24	18[illegible]5.02
47	10[illegible]5.00	707.98	604.54	780.48	-175.84	0.15	13204.02
48	10871.00	829.37	664.42	730.40	-65.98	0.21	27071.94
49	12464.00	751.27	636.45	737.83	-96.42	0.23	16515.59
50	11145.00	782.51	641.27	741.13	-99.86	0.19	33569.39
51	13[illegible]7.00	841.53	707.21	710.77	-3.56	0.31	18122.96
52	12198.00	1125.61	635.48	1075.21	-439.73	0.06	25[illegible]9.92
53	12033.00	764.05	643.97	762.23	-118.26	0.18	22534.26
54	16546.00	935.60	573.87	742.91	-169.93	0.25	22[illegible]4.54
55	12[illegible]3.00	782.12	726.49	729.32	-2.84	0.23	20456.99
56	14108.00	815.23	740.22	744.14	-3.92	0.24	23837.44
57	14263.00	990.91	745.33	726.46	18.87	0.28	18182.36
58	10977.00	623.64	527.74	748.29	-218.56	0.17	25313.84
59	12368.00	740.43	695.84	732.31	-36.46	0.23	16948.30
60	12043.00	829.88	675.57	716.70	-41.13	0.26	23238.30
61	10917.00	794.95	587.39	787.95	-200.56	0.14	27238.73
62	11902.00	646.01	590.47	750.12	-159.65	0.19	25729.75
63	19221.00	1092.82	647.99	759.16	-111.28	0.29	26028.13
64	22938.00	1043.63	701.81	806.72	-104.91	0.27	29886.23
65	10243.00	718.08	609.67	748.47	-139.80	0.17	20167.13
66	12455.00	736.79	734.06	734.77	-0.71	0.23	19625.93
67	10464.00	751.97	549.11	757.23	-208.12	0.16	32627.05
68	17929.00	987.71	742.56	761.45	-18.89	0.27	30048.84
69	11084.00	735.34	659.46	753.99	-94.53	0.18	23057.61

TOWN	INCOME	DESIRED SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT
107	14401.00	1005.00	738.60	740.35	-1.75	0.29	20339.50
108	13708.00	792.46	714.03	735.21	-21.17	0.25	23018.04
109	11650.00	744.76	738.23	719.72	18.51	0.24	47007.09
110	10245.00	756.46	645.87	777.28	-131.40	0.14	24617.44
111	11304.00	688.00	559.19	787.16	-227.96	0.15	30484.64
112	12080.00	744.60	701.57	737.95	-36.38	0.21	18524.79
113	10[illegible]5.00	737.[illegible]	[illegible]3.43	744.67	-151.24	0.18	21432.23
114	13417.00	857.81	731.54	757.69	-24.14	0.21	30283.67
115	12156.00	711.40	692.78	715.60	-22.82	0.26	16090.35
116	12885.00	887.81	735.20	736.75	-1.55	0.33	39736.13
117	17810.00	1107.13	650.92	800.38	-149.47	0.21	36191.84
118	10823.00	759.87	726.87	737.91	-11.24	0.19	30130.91
119	10531.00	601.15	630.30	764.94	-136.63	0.15	23149.13
120	12444.00	675.53	699.18	709.30	-20.13	0.29	13011.01
121	13814.00	834.12	679.48	759.08	-79.60	0.21	32063.72
122	14479.00	656.52	667.61	740.72	-73.11	0.25	26174.79
123	12197.00	801.05	568.98	768.17	-199.20	0.18	34995.41
124	9877.00	715.04	563.46	704.73	-141.27	0.23	35847.89
125	12099.00	1002.85	598.85	782.52	-183.68	0.16	37638.50
126	13764.00	1123.09	593.76	769.10	-175.34	0.30	26263.61
127	10297.00	655.72	585.94	780.00	-194.06	0.14	40558.84
128	23371.00	1263.46	475.78	858.61	-382.83	0.22	43958.85
129	13863.00	913.58	674.65	735.95	-61.30	0.25	23205.50
130	11598.00	774.57	651.44	734.97	-83.53	0.21	21222.89
131	12467.00	851.72	713.71	714.10	-0.38	0.27	18301.06
132	20483.00	1409.74	317.90	891.74	-563.85	0.24	41233.38
133	12034.00	950.73	566.75	747.96	-179.20	0.20	42038.75
134	10446.00	1018.78	714.02	773.85	-59.83	0.27	36124.87
135	12712.00	692.10	707.24	729.80	-22.56	0.24	26875.61
136	11722.00	754.54	487.44	713.97	-226.53	0.26	21245.64
137	14488.00	873.68	752.19	730.45	21.75	0.28	22909.59
138	12204.00	787.22	654.82	705.92	-51.11	0.29	24386.43
139	15378.00	1069.68	678.60	791.40	-112.80	0.24	35219.39
140	12459.00	720.94	713.76	772.94	-59.17	0.17	24756.06
141	12506.00	823.14	696.11	731.86	-35.74	0.23	21996.65
142	11321.00	942.56	595.79	769.15	-173.36	0.16	21087.96
143	10347.00	813.93	638.64	707.70	-69.06	0.24	47444.09

A striking result of Table 20 is that very few towns gain from Plan 1a, and those that do are not low-income towns. The average per-student loss from the plan across all towns is $123.07. Towns that gain are mostly middle-income communities with high student to population ratios. No communities receive large gains. All of the cities suffer losses, some of them of considerable magnitude. The cities lose because they have low student to population ratios and, in some cases, because expenditure in cities is higher than average statewide expenditure.

Table 21 shows how gains are distributed by town characteristics. Equation (21.1) indicates that lower-income towns, on the average, do better under the plan than higher income towns. However, the variance in income explains only 5 percent of the variance in net gains. Further, setting GAIN1A equal to zero in equation (21.1) yields a break-even income of only $685. Therefore, the equation predicts losses for all income levels. Equation (21.4) shows that low-expenditure towns gain more than high-expenditure towns. Finally, equation (21.6) indicates a gain of $16.25 for every increase of 0.1 in the student to population ratio. Low-income suburbd with many school children and little industry appear to fare best under the plan, while high-income cities, such as Brookline, are hurt the most. Since in general the more densely populated areas have lower income, the result is that most communities suffer moderate losses. Table 22 shows that Plan 1b is much worse than 1a. Only two towns gain under Plan 1b, and the losses for other towns are much larger than under 1a. The loss per student for the state is $331.58. Table 23 shows the distribution of gains under Plan 1b by community characteristics.

Table 21.

Distribution of Gains by Town Characteristics

Plan 1a

Equation (21.1):

GAIN1A = -6.031 - 0.0088 MENINC
(0.14) (2.62)

R^2 = 0.0510 F(1,128) = 6.873

Equation (21.2):

GAIN1A = -4.262 - 0.0044 TAXSTD
(0.18) (5.74)

R^2 = 0.2051 F(1,128) = 33.018

Equation (21.3):

GAIN1A = 27.37 - 0.0023 MENINC - 0.0042 TAXSTD
(0.67) (0.69) (5.02)

R^2 = 0.4049 F(1,128) = 87.081

Equation (21.5):

GAIN1A = 246.8 + 0.0132 MENINC - 0.0016 TAXSTD - 0.5762 EXPRST
(5.80) (4.00) (2.14) (8.25)

R^2 = .4857 F(3,26) = 39.669

Equation (21.6):

GAIN 1A = -195.3 - 0.0175 MENINC - 0.0020 TAXSTD + 1625.6 BURDEN
(5.18) (6.00) (1.74) (10.11)

R^2 = .5625 F(3,126) = 54.001

TOWN	INCOME	DESIRED SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT
1	12460.00	858.99	977.75	1086.19	-108.44	0.24	17125.12
2	16348.00	887.54	847.61	1117.01	-269.40	0.30	22125.79
3	10191.00	748.00	808.32	1172.65	-364.33	0.17	24225.65
4	11429.00	858.74	835.67	1114.19	-278.52	0.22	30374.57
5	10[illegible].00	816.78	890.23	1193.22	-302.99	0.18	19843.05
6	14[illegible].00	837.[illegible]	[illegible].42	1669.18	-560.76	0.12	39738.01
7	16585.00	1048.49	1069.04	1217.30	-148.26	0.25	32883.16
8	13334.00	935.45	1104.23	1351.82	-245.59	0.17	36965.36
9	10518.00	834.24	644.75	1076.41	-431.65	0.21	16529.87
10	12[illegible]6.00	835.46	782.77	1130.92	-348.14	0.21	8992.67
11	12152.00	856.05	968.43	1080.00	-81.58	0.24	20279.70
12	11306.00	832.16	913.21	1048.61	-135.40	0.24	57139.52
13	15426.00	1001.25	919.34	1109.25	-189.91	0.28	25029.09
14	11446.00	822.63	782.18	1041.85	-259.66	0.24	12665.04
15	17133.00	898.13	1076.10	1523.32	-447.22	0.17	51193.40
16	12966.00	727.76	856.74	1191.22	-334.48	0.21	28084.45
17	11786.00	865.99	845.92	987.64	-141.73	0.29	13140.88
18	10772.00	935.24	765.95	1311.28	-545.33	0.14	21246.54
19	9023.00	850.85	586.55	884.27	-297.72	0.32	22736.77
20	13894.00	844.58	917.64	1107.40	-189.76	0.26	31074.77
21	11675.00	838.32	907.32	1043.21	-135.89	0.25	16159.41
22	11169.00	796.37	802.34	1052.70	-220.37	0.22	17708.75
23	18[illegible]0.00	1470.93	1236.19	2263.40	-1027.22	0.11	81498.50
24	13672.00	896.13	859.08	988.06	-128.98	0.33	28043.95
25	12012.00	1327.84	918.40	1741.89	-823.49	0.10	51133.41
26	15076.00	912.18	989.34	1225.85	-236.52	0.22	40037.38
27	14672.00	767.74	922.70	1097.09	-174.39	0.28	15752.47
28	9832.00	748.78	782.94	1180.44	-417.50	0.16	16701.11
29	10[illegible]8.00	820.83	648.85	1140.07	-493.21	0.19	17630.51
30	11005.00	795.13	784.31	1324.76	-540.45	0.14	26014.66
31	21563.00	1107.51	1110.90	1313.06	-202.17	0.28	35720.26
32	13136.00	888.67	1005.35	1186.33	-180.97	0.21	29146.68
33	11[illegible]0.00	730.47	896.81	1088.59	-191.78	0.22	10584.59
34	14279.00	720.79	848.29	1184.03	-335.74	0.23	39100.75
35	11908.00	793.11	954.80	1056.23	-101.44	0.24	15993.06
36	11055.00	780.66	835.84	1190.28	-354.40	0.18	29792.03
37	10[illegible]2.00	706.75	829.34	1147.10	-317.75	0.28	24207.52
38	12651.00	729.38	891.51	1025.33	-133.82	0.28	19704.33
39	10689.00	957.54	927.50	1197.05	-269.53	0.17	54413.92
40	10298.00	760.55	941.62	1098.88	-157.26	0.19	24825.42

TOWN	INCOME	DESIRED SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT
41	9090.00	901.42	744.15	1230.60	-486.45	0.13	9806.40
42	14072.00	846.07	790.29	970.61	-180.32	0.28	43534.92
43	10360.00	764.85	727.23	1203.27	-476.05	0.15	27152.43
44	12741.00	951.72	640.51	1090.65	-450.13	0.24	22365.89
45	14262.00	864.26	934.16	1167.76	-233.60	0.24	29771.04
46	12147.00	813.16	986.32	1016.84	-30.52	0.24	18435.02
47	10995.00	702.98	745.22	1296.05	-550.83	0.15	13204.02
48	10971.00	82 [illegible]	877.24	1095.61	-218.37	0.21	27091.94
49	12654.00	751.27	794.69	1105.54	-310.88	0.23	19515.59
50	11145.00	792.51	926.87	1138.57	-311.70	0.19	33569.39
51	13587.00	841.53	937.26	1017.07	-79.81	0.31	18122.96
52	12188.00	1125.61	1188.13	2476.51	-1287.38	0.06	25769.92
53	12033.00	764.05	800.70	1223.01	-422.31	0.18	22834.26
54	16545.00	935.60	828.42	1145.27	-316.85	0.28	28884.54
55	12093.00	782.12	922.58	1091.30	-168.72	0.23	20456.95
56	14108.00	815.23	969.90	1150.62	-180.72	0.24	23837.44
57	14263.00	950.91	1091.99	1079.86	12.13	0.28	18182.36
58	10277.00	623.64	615.55	1159.23	-543.68	0.17	25318.84
59	12368.00	740.43	881.23	1103.25	-222.02	0.23	16948.30
60	12043.00	829.88	904.02	1040.80	-136.78	0.26	23238.30
61	10017.00	[illegible]	756.84	1329.92	-573.08	0.14	27298.73
62	11902.00	646.01	697.95	1174.53	-476.58	0.19	25729.75
63	19221.00	1092.82	1174.32	1210.71	-36.38	0.29	26028.13
64	23438.00	1043.63	1208.43	1401.05	-192.63	0.27	29386.23
65	10243.00	716.06	754.51	1167.92	-413.42	0.17	20167.13
66	12456.00	736.79	927.70	1113.09	-185.39	0.23	19625.93
67	10464.00	751.97	667.14	1202.99	-535.85	0.16	32627.05
68	17429.00	987.71	1150.37	1219.89	-69.51	0.27	30048.24
69	11084.00	735.34	820.00	1190.03	-369.97	0.18	23057.61
70	15129.00	943.47	1109.43	1417.87	-308.44	0.21	44184.14
71	11786.00	608.74	764.30	1086.91	-322.62	0.23	19703.30
72	13454.00	858.59	935.03	1070.65	-135.57	0.28	22116.70
73	12101.00	800.36	932.53	1289.10	-357.57	0.16	28884.56
74	13936.00	858.58	1036.38	1184.82	-148.44	0.22	25648.85
75	11429.00	697.75	867.18	1279.22	-412.05	0.16	26007.29
76	10841.00	652.06	749.85	1035.48	-285.64	0.23	19353.75
77	10855.00	778.92	924.20	1222.04	-297.83	0.16	27598.05
78	11225.00	754.14	843.69	1114.03	-270.33	0.20	18499.36
79	18112.00	1014.07	1171.95	1649.41	-477.46	0.16	55124.04
80	14423.00	873.59	952.37	1093.66	-141.30	0.27	26877.66
81	18726.00	1011.74	1036.83	1296.03	-259.20	0.25	39895.91
82	9032.00	768.63	752.16	1180.44	-428.27	0.15	24568.85

TOWN	INCOME	DESIRED SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT
83	10774.00	726.83	813.37	1111.08	-297.71	0.20	24920.71
84	19868.00	1232.44	1164.19	1580.25	-416.07	0.19	43037.47
85	9567.00	812.18	795.13	1078.51	-283.38	0.19	20463.70
86	11497.00	945.06	948.52	1282.00	-333.48	0.19	30144.38
87	13213.00	791.85	754.05	1278.46	-524.41	0.19	35362.37
88	11587.00	710.21	946.07	1125.66	-179.59	0.21	21908.97
89	10469.00	786.27	922.96	1101.60	-260.64	0.20	19473.53
90	13769.00	841.69	1013.55	1010.99	2.56	0.33	18131.94
91	13811.00	849.03	804.93	1172.44	-277.46	0.23	25213.54
92	10966.00	771.01	948.84	966.40	-17.56	0.24	11502.50
93	10871.00	740.51	758.33	1090.13	-331.80	0.20	29066.84
94	12599.00	817.68	912.46	1150.23	-237.77	0.21	75463.50
95	11845.00	838.14	931.10	1030.90	-199.80	0.25	18119.71
96	11730.00	891.40	800.92	1140.33	-339.42	0.20	25308.96
97	10586.00	808.59	819.22	1101.61	-282.38	0.20	52508.13
98	12111.00	915.57	885.69	1229.84	-344.14	0.18	27727.69
99	13059.00	838.11	962.69	1068.63	-135.94	0.25	17687.95
100	14833.00	813.76	1022.99	1136.33	-113.35	0.26	25710.89
101	11004.00	834.98	970.79	1206.70	-235.91	0.17	26314.43
102	11226.00	751.05	836.65	1020.33	-183.68	0.25	19237.20
103	10777.00	890.38	868.65	1229.41	-360.76	0.15	35590.43
104	12322.00	782.41	923.64	1089.69	-166.05	0.24	33016.41
105	14731.00	798.63	908.32	1024.92	-116.58	0.35	21256.44
106	12660.00	879.50	1033.67	1067.87	-34.20	0.25	23401.58
107	10431.00	1005.00	1124.06	1135.43	-11.37	0.29	20339.50
108	13708.00	788.46	918.86	1114.55	-195.98	0.25	23018.04
109	11699.00	796.76	933.21	1052.86	-119.65	0.24	47097.09
110	10755.00	754.46	806.28	1283.21	-476.93	0.14	24617.44
111	11326.00	689.00	675.42	1322.75	-647.33	0.15	30884.84
112	12030.00	744.60	885.52	1125.82	-240.30	0.21	19506.79
113	10358.00	787.38	745.08	1152.74	-407.65	0.18	21432.23
114	13612.00	857.81	998.12	1204.82	-209.70	0.21	30293.67
115	12156.00	711.40	850.91	1036.37	-185.46	0.25	16990.35
116	13385.00	887.81	1034.47	1121.01	-86.54	0.33	84236.13
117	17819.00	1109.13	1215.41	1375.67	-160.27	0.21	36191.84
118	10423.00	759.87	919.85	1125.67	-205.82	0.19	30130.91
119	10531.00	691.15	764.24	1241.94	-477.60	0.15	23349.13
120	12444.00	675.53	822.68	1011.19	-188.51	0.29	13011.01

TOWN	INCOME	DESIRED SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT
121	13419.00	894.12	903.79	1206.39	-302.61	0.21	32263.72
122	14479.00	958.52	964.48	1136.92	-142.44	0.25	25174.79
123	12192.00	801.96	734.34	1226.77	-492.43	0.18	34886.41
124	9677.00	715.04	692.58	992.87	-310.29	0.23	35047.89
125	12038.00	1008.85	957.05	1304.22	-347.17	0.16	37538.50
126	19784.00	1123.09	1148.62	1210.48	-61.86	0.30	28268.61
127	10227.00	656.12	664.31	1267.72	-602.42	0.14	40556.84
128	23371.00	1263.46	1237.13	1608.69	-371.55	0.22	43358.85
129	13668.00	913.58	976.46	1117.86	-139.40	0.25	28205.50
130	11698.00	774.57	823.87	1113.91	-290.04	0.21	21222.89
131	12457.00	851.72	945.81	1030.37	-84.56	0.27	18301.06
132	30693.00	1409.74	1283.45	1701.28	-417.82	0.26	41233.38
133	12024.00	850.73	771.88	1165.88	-394.00	0.20	42398.75
134	19465.00	1018.78	1117.26	1269.51	-152.25	0.27	36128.87
135	12712.00	692.10	862.18	1093.20	-231.02	0.24	24875.61
136	11722.00	754.54	612.99	1029.85	-416.86	0.26	21345.64
137	14968.00	873.68	1036.79	1035.80	-59.01	0.28	23909.59
138	12204.00	787.22	837.42	967.67	-130.24	0.29	24386.48
139	19878.00	1056.68	1178.57	1339.73	-161.16	0.24	35219.39
140	12459.00	720.84	573.53	1265.84	-392.31	0.17	24766.06
141	12505.00	823.14	922.26	1101.45	-179.19	0.23	21996.65
142	11321.00	942.56	840.20	1250.70	-410.50	0.16	21087.96
143	10347.00	813.93	839.03	1004.76	-165.73	0.24	47444.09

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Table 23.

Distribution of Gains by Town Characteristics

Plan 1b

Equation (23.1):

GAIN 1b = -427.7 + 0.0087 MENINC
(5.54) (1.48)

R^2 = 0.0168 F(1,128) = 2.192

Equation (23.2):

GAIN 1b = -191.6 - 0.0045
(4.43) (3.15)

R^2 = 0.0717 F(1,128) = 9.893

Equation (23.3):

GAIN 1b = -377.8 + 0.0185 MENINC - 0.0063 TAXSTD
(5.13) (3.08) (4.19)

R^2 = .1361 F(2,127) = 10.007

Equation (23.4):

GAIN 1b = -33.01 - 0.3336 EXPRST
(0.35) (3.03)

R^2 = 0.0669 F(1,128) = 9.170

Equation (23.5):

GAIN 1b = -135.9 + 0.0356 MENINC - 0.0034 TAXSTD - 0.6349 EXPRST
(1.54) (5.20) (2.21) (4.39)

R^2 = 0.2506 F(3,126) = 14.044

Equation 23.6):

GAIN 1b = -795.9 - 0.0101 MENINC - 0.0006 TAXSTD + 3052.5 BURDEN
(12.26) (2.00) (0.55) (11.03)

R^2 = .5603 F(3,126) = 53.523

The computation of the maximum feasible price for Plan 2a is altered from the computation in section C in two important ways. First, relative wealth per student rather than relative income is used in the computations. The ratio of maximum wealth per student to mean wealth per student is 2.846, compared to a value of 2.407 for the ratio of maximum mean family income to statewide mean family income. Second, the ratio of RPRIV to RPUB for every town is used in equation (20), in place of the state average of the ratio RPRIV to RPUB. Both of these changes lower the minimum value of the maximum feasible price, making the net subsidy required for a power-equalizing plan with no town exercising the dropout option much higher.

Table 24 shows that only a few towns gain from Plan 2a and that the gains are very small compared with the losses absorbed by most of the other towns. The twenty towns with positive gains have an average income of 13,257, compared to an average of 12,751 in the state as a whole. The aggregate statewide gain is -$189.72 per student. Equation (25.1) in Table 25 shows a pattern of distribution of gains with respect to income roughly the same as the pattern for statewide financing Plan 1a, except that the losses are slightly larger. Equation (25.5) shows that gains vary directly with expenditure and income, when wealth is held constant. The biggest gainers from power-equalizing are low-wealth communities with high incomes and a strong taste for education; that is, suburbs with little industry and not too many extremely wealthy residents. Cities in general fare poorly under the power-equalizing plan.

TABLE 24

TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EP0	EP1
1	12450.00	858.99	674.30	609.01	65.29	0.24	17125.12	880.01	1363.58
2	16782.00	687.54	466.10	609.03	-142.93	0.30	22115.79	686.70	986.84
3	10191.00	748.00	418.67	609.06	-190.39	0.17	24225.85	746.68	1036.10
4	11929.00	688.74	321.84	609.03	-287.19	0.22	30374.57	687.16	874.11
5	10698.00	816.78	536.80	609.05	72.25	0.18	19663.05	815.29	1227.30
6	14034.00	837.36	206.22	609.34	-403.12	0.12	39738.01	833.36	956.06
7	10595.00	1048.49	429.27	609.09	-179.81	0.25	32963.16	1046.57	1290.13
8	13386.00	936.45	303.77	609.18	-305.40	0.17	39985.36	932.92	1078.18
9	10598.00	634.24	424.92	609.01	-184.09	0.21	16529.87	633.73	1018.64
10	12066.00	835.46	681.80	609.04	72.57	0.21	8992.67	837.16	1700.25
11	12152.00	855.05	607.01	609.01	-1.99	0.24	20279.70	855.82	1271.55
12	11306.00	932.16	-4.47	608.99	-613.46	0.24	57139.52	926.33	924.25
13	15426.00	1001.25	512.25	609.02	-96.78	0.24	25029.09	1001.59	1372.50
14	11448.00	622.63	587.92	608.99	-21.06	0.24	2655.04	622.67	1108.99
15	17133.00	898.13	86.73	609.26	-522.53	0.17	51193.40	893.11	929.55
16	12966.00	727.76	367.28	609.07	-241.80	0.21	28084.45	726.09	951.89
17	11765.00	665.99	615.07	608.96	6.11	0.24	13140.88	667.22	1171.24
18	10772.00	935.24	485.80	609.14	-123.33	0.14	21246.54	933.78	1362.76
19	9623.00	850.85	463.96	608.90	-144.94	0.32	22736.77	850.27	1208.97
20	13994.00	844.58	367.89	609.02	-241.13	0.26	31074.77	843.25	1063.31
21	11675.00	808.35	639.43	608.99	30.44	0.25	16159.41	809.54	1312.51
22	11165.00	796.37	569.31	609.01	-39.70	0.22	17708.75	796.84	1247.25
23	15686.00	1478.93	-554.71	609.68	-1164.39	0.11	81493.50	1458.51	1259.61
24	13622.00	898.13	400.62	608.96	-208.34	0.33	28043.96	897.05	1376.66
25	12012.00	1327.94	94.93	609.39	-514.46	0.10	51133.41	1320.54	1375.05
26	15038.00	912.16	253.70	609.09	-355.40	0.22	40037.38	908.94	1039.77
27	14672.00	787.74	656.32	609.02	47.30	0.28	15752.47	787.91	1257.27
28	9832.00	798.78	544.00	609.07	-65.07	0.16	16701.11	798.09	1277.64
29	10928.00	820.63	424.80	609.04	-184.25	0.18	17630.51	819.44	971.23
30	11005.00	795.13	382.97	609.15	-226.18	0.14	26014.66	793.03	1070.70
31	21563.00	1107.51	404.69	609.14	-204.45	0.28	35720.26	1104.47	1320.08
32	13136.00	888.67	460.00	609.07	-149.07	0.21	26146.68	887.40	1162.37

TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EP0	EP1
33	11640.00	730.47	721.73	609.01	112.72	0.22	10584.59	731.34	1395.13
34	14279.00	720.79	209.56	609.07	-399.51	0.23	39100.75	718.09	828.96
35	11908.00	793.11	641.84	609.00	32.84	0.24	16993.05	794.02	1262.09
36	11055.00	780.66	353.11	609.07	-255.96	0.18	29792.03	778.70	987.95
37	16892.00	705.75	413.26	609.05	-195.78	0.28	24207.52	705.61	979.40
38	12691.00	739.38	546.42	608.98	-62.56	0.28	19704.38	739.71	1111.26
39	10869.00	957.54	32.81	609.07	-576.26	0.17	54413.92	952.01	967.89
40	10298.00	790.55	481.41	609.02	-127.61	0.19	24325.42	789.89	1085.31
41	9660.00	801.42	672.13	609.09	63.04	0.13	9830.40	800.95	1573.45
42	11672.00	846.07	156.69	608.95	-452.25	0.28	43534.92	843.46	934.30
43	10390.00	784.85	350.71	609.08	-258.37	0.16	27162.43	782.91	1013.08
44	12741.00	951.72	384.40	609.01	-224.61	0.24	22395.89	952.48	1352.19
45	14262.00	864.26	398.03	609.06	-211.02	0.24	29771.04	862.76	1105.99
46	12147.00	813.16	621.56	609.00	12.56	0.24	18495.02	814.14	1253.21
47	10995.00	702.98	542.35	609.13	-66.78	0.15	13204.02	701.94	1229.92
48	10971.00	829.37	418.98	609.02	-190.03	0.21	27091.94	828.56	1101.35
49	12664.00	751.27	545.80	609.02	-63.22	0.23	16515.59	751.20	1207.75
50	11145.00	792.51	293.92	609.04	-315.12	0.19	33589.39	790.44	967.57
51	13567.00	841.53	625.79	608.97	16.81	0.31	18122.96	843.13	1308.09
52	12184.00	1125.41	660.70	609.80	50.90	0.06	25969.92	1120.91	1514.38
53	12033.00	764.05	455.71	609.09	-153.38	0.18	22834.26	762.40	1082.25
54	12646.00	935.60	380.79	609.05	-229.26	0.28	25884.54	934.59	1212.07
55	12083.00	732.12	561.35	609.01	-47.65	0.23	20456.95	781.89	1157.82
56	14108.00	815.23	520.00	609.05	-89.05	0.24	23837.44	814.36	1137.07
57	14263.00	950.91	749.45	609.01	140.44	0.28	18182.36	952.64	1476.36
58	10277.00	627.64	306.24	609.05	-362.82	0.17	25318.84	621.89	848.43
59	12366.00	740.43	570.85	609.02	-38.17	0.23	16948.30	740.60	1178.94
60	12048.00	829.88	492.04	608.99	-116.94	0.26	23238.30	830.43	1170.90
61	10917.00	79 95	355.46	609.15	-253.69	0.14	27238.73	792.59	1051.49
62	11902.00	646.01	338.13	609.06	-270.93	0.19	25729.75	644.25	873.52
63	19421.00	1093.82	640.42	609.08	31.34	0.29	26028.13	1092.76	1475.07
64	22938.00	1043.63	545.94	609.19	-63.25	0.27	29886.23	1041.27	1332.85
65	10243.00	716.09	440.44	609.06	-168.62	0.17	20167.13	715.17	1004.85
66	12456.00	730.79	548.34	609.03	-60.68	0.23	19625.93	736.54	1108.19
67	10464.00	751.97	267.77	609.08	-341.31	0.16	32627.05	749.31	927.32
68	17929.00	987.71	509.11	609.09	-99.98	0.27	30048.84	986.19	1259.71
69	11084.00	735.34	442.65	609.07	-166.39	0.15	23057.61	733.98	1038.01

TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EPC	EPI
70	18124.00	943.47	209.84	609.20	-399.36	0.21	44184.14	939.15	1034.40
71	11766.00	676.74	437.52	609.01	-171.49	0.23	19706.30	607.98	913.29
72	13994.00	800.59	533.19	609.00	-75.82	0.28	22116.70	859.22	1234.75
73	12101.00	690.35	405.23	609.13	-203.90	0.16	28864.56	798.16	1035.41
74	13335.00	648.58	513.86	609.07	-95.21	0.22	25548.85	857.69	1177.89
75	11427.00	697.75	414.80	609.12	-194.32	0.16	26007.29	665.69	939.38
76	10581.00	688.06	453.46	609.98	-155.53	0.23	19363.75	651.74	985.69
77	10859.00	775.92	415.55	609.09	-193.54	0.16	27544.06	777.14	1025.73
78	13676.00	754.14	542.01	609.08	-67.01	0.20	18449.36	753.80	1160.22
79	15112.00	1014.37	29.25	609.33	-580.08	0.16	55129.04	1007.98	1019.66
80	14403.00	873.59	453.71	609.02	-155.31	0.27	20877.66	873.32	1164.39
81	13726.00	1011.74	274.80	609.13	-334.33	0.25	39895.91	1008.29	1154.99
82	9832.00	783.63	394.59	609.05	-214.47	0.15	24568.85	787.17	1058.80
83	10774.00	726.85	411.43	609.03	-197.59	0.20	24920.71	725.70	996.11
84	15668.00	1233.44	349.61	609.29	-259.68	0.19	48037.47	1228.63	1405.47
85	9537.00	812.18	490.86	609.01	-118.14	0.19	20453.70	812.23	1202.82
86	11477.00	945.08	421.26	609.12	-187.84	0.16	30194.38	942.80	1202.05
87	13813.00	791.25	240.76	609.12	-368.34	0.18	35352.37	788.48	946.17
88	11567.00	710.21	502.86	609.03	-106.17	0.21	21968.97	709.57	1022.32
89	10449.00	788.27	511.19	609.02	-97.83	0.20	19473.53	785.19	1186.45
90	13269.00	841.69	671.44	608.97	62.47	0.30	18131.94	843.55	1308.41
91	13811.00	849.03	441.46	609.00	-167.50	0.23	26213.54	847.87	1141.39
92	10956.00	771.01	754.03	608.94	145.09	0.28	11502.50	774.17	1430.36
93	10671.00	740.51	322.69	609.01	-286.32	0.20	27055.84	739.19	996.49
94	12592.00	812.68	-223.71	609.05	-832.76	0.21	75463.56	805.32	722.04
95	11045.00	693.14	527.00	608.98	-81.98	0.25	18119.71	683.22	1060.01
96	11780.00	891.40	444.16	609.04	-164.89	0.29	25308.96	890.22	1214.69
97	10866.00	805.59	51.29	609.02	-557.73	0.20	52508.13	804.14	828.84
98	12111.00	915.57	432.35	609.09	-176.75	0.18	27727.69	913.84	1203.92
99	13059.00	838.[illegible]	645.82	609.82	36.81	0.25	17567.95	838.78	1316.34
100	14833.00	813.78	501.68	609.04	-107.36	0.26	25710.89	812.90	1102.49
101	11064.00	834.98	482.15	609.08	-126.93	0.17	26314.43	833.42	1120.28
102	11220.00	751.05	579.44	608.97	-29.54	0.25	16237.20	751.99	1216.95
103	10777.00	860.38	291.34	609.09	-317.75	0.16	35590.63	887.63	1062.39
104	12322.00	782.41	333.15	609.01	-275.86	0.24	33016.41	780.73	991.81
105	14791.00	795.83	531.26	608.98	-77.71	0.33	21256.44	796.48	1162.17
106	12680.00	879.50	561.04	609.00	-47.96	0.25	23401.58	880.24	1237.80

TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EPC	EPI
107	16481.00	1005.00	538.96	609.04	129.82	0.29	20339.50	1006.05	1493.05
108	13708.00	788.46	489.71	609.03	-119.31	0.25	23018.04	787.92	1086.73
109	11650.00	745.76	126.49	608.99	-482.50	0.24	47097.09	743.42	798.96
110	10265.00	754.46	420.85	609.12	-188.28	0.14	24517.44	754.47	1040.48
111	11326.00	660.00	266.42	609.15	-342.73	0.15	30894.84	685.45	866.37
112	13036.00	744.50	532.87	609.03	-76.16	0.21	19536.79	744.21	1122.36
113	10358.00	787.38	450.89	609.05	-158.16	0.18	21432.23	786.34	1143.78
114	13612.00	857.81	415.98	609.08	-193.10	0.21	30293.67	855.94	1089.94
115	12156.00	711.40	561.50	608.98	-47.49	0.26	16930.35	711.81	1132.02
116	10395.00	887.81	-387.54	609.03	-996.57	0.33	84236.13	877.84	754.48
117	17819.00	1109.13	423.21	609.18	-185.97	0.21	36191.84	1105.89	1315.14
118	10923.00	759.87	376.87	609.03	-232.16	0.19	30130.91	758.24	967.52
119	10531.00	691.15	404.26	609.10	-204.84	0.15	23349.13	689.41	970.28
120	12444.00	675.53	632.05	608.97	23.08	0.29	13011.01	676.11	1191.40
121	13819.00	834.12	347.53	609.08	-261.55	0.21	32063.72	831.96	1036.52
122	14479.00	955.52	511.24	609.04	-97.80	0.25	26174.79	958.26	1290.73
123	12192.00	801.95	247.27	609.09	-361.82	0.18	34836.41	799.30	964.05
124	9577.00	715.04	221.32	608.96	-387.63	0.23	35647.89	713.23	851.30
125	12039.00	1008.85	288.82	609.14	-320.31	0.16	37938.50	1005.60	1174.40
126	14784.00	1123.09	627.73	609.05	18.64	0.30	25268.61	1123.27	1510.91
127	10227.00	695.72	163.84	609.13	-445.29	0.14	40558.84	652.65	742.69
128	23371.00	1263.46	283.73	609.31	-325.57	0.22	43958.85	1257.89	1388.18
129	13483.00	913.58	545.93	609.03	-63.10	0.25	23209.50	913.91	1289.30
130	11598.00	774.57	486.55	609.03	-122.48	0.21	21222.89	774.00	1130.06
131	12467.00	851.72	635.51	608.98	26.53	0.27	18301.06	853.10	1315.53
132	30698.00	1409.74	398.99	609.36	-210.38	0.26	41233.35	1404.07	1586.10
133	12094.00	850.73	168.05	609.06	-440.98	0.20	42093.75	847.48	950.94
134	19465.00	1018.78	379.44	609.12	-229.68	0.27	36128.87	1015.89	1208.92
135	12712.00	692.10	394.30	609.02	-214.72	0.24	26875.61	690.87	921.16
136	11722.00	754.	355.54	608.98	-253.44	0.26	21245.64	754.78	1101.54
137	14956.00	873.58	582.74	609.02	-26.28	0.28	22909.59	873.89	1238.94
138	12204.00	747.22	440.90	608.96	-168.06	0.29	24386.46	727.59	1040.09
139	19378.00	1068.73	423.73	609.16	-185.43	0.24	35219.39	1065.74	1280.73
140	12459.00	720.84	449.80	609.11	-159.32	0.17	24766.06	718.86	989.07
141	12505.00	823.14	526.27	609.02	-82.75	0.23	21998.65	823.07	1185.27
142	11321.00	942.56	531.16	609.10	-77.94	0.16	21087.96	941.68	1378.25
143	10347.00	813.93	113.05	608.96	-495.92	0.24	47444.09	810.52	868.62

Table 25.

Distribution of Gains By Town Characteristics

Plan 2a

Equation (25.1):

GAIN 2a = -66.54 - 0.0101 MENINC
(0.91) (1.81)

R^2 = 0.250 F(1,128) = 3.279

Equation (25.2):

GAIN 2a = 216.4 - 0.0147 TAXSTD
(13.83) (28.63)

R^2 = .8649 F(1,128) = 819.57

Equation (25.3):

GAIN 2a = 62.86 + 0.0152 MENINC - 0.0162 TAXSTD
(2.85) (8.46) (-36.13)

R^2 = .9136 F(2,127) = 671.181

Equation (25.4):

GAIN 2a = 151.5 - 0.4079 EXPRST
(1.72) (4.00)

R^2 = .1110 F(1,128) = 15.985

Equation (25.5):

GAIN 2a = -7.609 + 0.0103 MENINC - 0.0170 TAXSTD + 0.1850 EXPRST
(0.29) (4.99) (36.67) (4.24)

R^2 = .9244 F(3.126) = 513.317

Equation (25.6):

GAIN 2a = 30.37 + 0.0130 MENINC - 0.0158 TAXSTD + 237.18 BURDEN
(1.13) (6.27) (32.17) (2.07)

R^2 = .9164 F(3,126) = 460.473

Table 26 shows the relationship between new expenditure under power-equalizing and previous expenditure. The coefficient of EXPRST in equation (26.1) shows that, with the income and price elasticities estimated in (5.4) expenditure under the plan is positively correlated with previous expenditure. Since previous expenditure is not perfectly correlated with wealth, and the aid ratio is based on per-student wealth, the correlation between EXP2a and EXPRST is far from exact. The coefficient attached to EXPRST in equation (26.1) also indicates that the plan in general reduces expenditure disparities.

Table 27 shows that the losses from power-equalizing are greater when price is set equal to the ratio of district wealth to maximum wealth. Under Plan 2b, only four towns gain and the average statewide loss is $302.16 per student.

Tables 28 and 29 show the distribution of gains by twon characteristics and the distribution of expenditures, respectively.

Plan 3, the current Massachusetts Plan, is not an attractive plan to purists, since it appears like a patchwork version of percentage-equalization with limitations that don't allow the theoretical plan to work. Nonetheless, the Massachusetts Plan appears to be the best of the plans considered. The net loss per student in the state is only $28.60. In general, Plan 3 is mildly favorable to low income groups and does not hurt the big cities. The three biggest cities, Boston, Worcester and Springfield gain from plan 3 and lose from all the other plans. Table 30 shows the gains and losses for every town and city.

Table 26.

Effect of Plan 2a on Expenditures

by Town Characteristic

EXP2a = Expenditures under Plan 2a

Equation (26.1):

$$EXP2a = \underset{(7.84)}{583.3} + \underset{(7.69)}{0.6620}\ EXPRST$$

$$R^2 = 0.3157 \qquad F(1,128) = 59.044$$

Equation (26.2):

$$EXP2a = \underset{(10.78)}{432.3} + \underset{(24.84)}{1.3374}\ EXPRST + \underset{(1.86)}{249.75}\ BURDEN - \underset{(2.58)}{0.0077}\ MENINC - \underset{(24.52)}{0.0135}\ TAXSTD$$

$$R^2 = .8954 \qquad F(4,125) = 267.441$$

TABLE 27

TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EP0	EP1
1	12450.00	850.99	805.52	827.07	-21.55	0.24	17125.12	858.16	1583.10
2	16389.00	687.54	592.30	841.16	-248.35	0.30	22115.70	885.21	1145.70
3	10191.00	748.00	548.19	866.60	-318.41	0.17	24225.85	745.09	1202.93
4	11929.00	658.74	463.42	835.87	-371.44	0.22	30374.57	665.96	1015.25
5	10638.00	816.78	660.77	857.72	-196.94	0.18	19663.05	814.47	1424.77
6	14304.00	837.36	385.88	1093.65	-707.77	0.12	39738.01	831.58	1110.01
7	16595.00	1048.45	660.73	887.02	-226.29	0.25	32963.16	1045.31	1499.23
8	13330.00	936.45	553.76	948.53	-394.77	0.17	36985.36	931.55	1252.62
9	10596.00	634.24	504.07	822.59	-318.52	0.21	16529.87	632.22	1182.26
10	12086.00	835.46	749.14	847.52	-98.38	0.21	8992.67	834.91	1972.91
11	12152.00	855.09	753.23	824.24	-71.01	0.24	20279.70	854.19	1476.62
12	11306.00	932.16	264.16	809.88	-545.72	0.24	57139.52	927.09	1075.25
13	15426.00	1001.25	679.31	837.61	-158.30	0.26	25029.09	1000.07	1594.49
14	11448.00	622.63	669.45	806.79	-137.34	0.24	12655.04	621.04	1286.93
15	17133.00	868.13	368.53	1036.95	-668.42	0.17	51193.40	891.84	1079.99
16	12966.00	727.76	511.96	875.09	-363.13	0.21	28084.45	724.67	1109.35
17	11766.00	665.99	703.93	782.00	-78.07	0.29	13140.88	665.61	1359.46
18	10772.00	935.24	610.13	929.99	-319.86	0.14	21246.54	931.63	1581.92
19	9623.00	850.85	594.72	734.73	-140.01	0.32	22736.77	848.56	1403.80
20	13994.00	844.58	543.31	836.77	-293.46	0.26	31074.77	842.09	1235.46
21	11675.00	808.33	755.63	807.41	-51.78	0.25	16159.41	807.76	1523.74
22	11169.00	796.37	604.64	825.47	-140.83	0.22	17708.75	795.09	1447.98
23	13829.00	1470.93	44.94	1365.37	-1320.43	0.11	81493.50	1457.39	1476.06
24	13622.00	896.13	558.63	782.19	-223.56	0.33	28043.95	896.24	1367.82
25	12012.00	1327.84	399.94	1126.90	-726.95	0.10	51133.41	1319.02	1596.02
26	15089.00	912.18	480.48	890.93	-410.45	0.22	40037.38	907.89	1205.38
27	14572.00	767.74	772.00	832.05	-60.05	0.28	15752.47	766.07	1454.33
28	9832.00	798.78	646.52	870.16	-223.61	0.16	16701.11	796.11	1482.85
29	10523.00	620.63	510.19	851.70	-341.51	0.18	17630.51	617.85	1127.11
30	11005.00	793.13	515.42	936.16	-420.74	0.14	26014.66	791.27	1242.93
31	21563.00	1107.51	667.47	930.81	-263.34	0.28	35720.26	1103.04	1533.92
32	13156.00	886.67	642.11	872.85	-230.75	0.21	28146.68	885.91	1350.16

TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EP0	EP1
33	11680.00	736.47	805.31	828.16	-22.86	0.22	10584.59	729.41	1618.93
34	14279.00	720.79	383.57	871.80	-488.23	0.23	39100.75	717.06	983.10
35	11904.00	793.11	765.59	817.94	-52.35	0.24	18993.06	792.29	1485.94
36	11055.00	780.66	509.04	874.66	-366.62	0.18	29792.03	777.24	1158.95
37	10532.00	705.75	540.93	854.92	-313.93	0.28	24207.52	704.14	1137.15
38	12651.00	739.38	673.00	799.24	-126.16	0.24	19704.38	738.19	1290.30
39	10688.00	957.54	295.90	877.75	-581.85	0.17	54413.92	951.86	1125.96
40	10798.00	790.55	636.23	832.86	-196.64	0.19	24825.42	786.43	1251.01
41	9656.00	871.42	744.31	893.10	-148.79	0.13	9806.40	796.70	1325.54
42	11072.00	846.07	348.32	774.21	-427.89	0.28	43534.92	843.58	1087.20
43	10380.00	734.85	481.06	800.60	-319.55	0.16	27162.43	761.31	1176.23
44	12741.00	951.72	490.57	829.10	-338.53	0.24	22395.89	950.85	1582.19
45	14262.00	864.26	572.59	864.36	-291.77	0.24	29771.04	861.38	1284.76
46	12147.00	813.16	754.50	818.21	-63.71	0.24	18496.02	812.49	1455.15
47	10495.00	702.98	620.90	923.03	-302.13	0.15	13204.02	700.02	1427.10
48	10971.00	829.37	574.29	831.37	-257.08	0.21	27091.94	827.20	1279.31
49	12664.00	751.27	647.42	835.91	-188.49	0.23	16515.59	749.41	1401.85
50	11145.00	772.51	458.74	851.02	-392.27	0.19	33569.39	769.24	1124.06
51	13587.00	841.53	755.37	795.48	-39.08	0.31	18122.96	841.53	1518.99
52	12188.00	1125.61	888.18	1462.36	-574.18	0.06	25969.92	1117.94	1757.31
53	12033.00	764.05	584.76	889.63	-304.87	0.18	22834.26	760.63	1256.27
54	10546.00	935.60	538.78	854.08	-315.30	0.28	28684.54	933.21	1408.16
55	12033.00	702.12	567.97	829.40	-131.41	0.23	20456.95	780.23	1344.27
56	14109.00	815.23	677.10	856.52	-179.43	0.24	23637.44	812.75	1320.34
57	14607.00	950.91	906.49	824.17	82.32	0.28	18182.36	951.00	1714.42
58	10277.00	823.64	407.60	860.46	-452.86	0.17	25318.84	820.45	984.86
59	12348.00	740.43	680.47	834.67	-154.39	0.23	16948.30	738.89	1268.53
60	12043.00	829.88	635.41	806.31	-170.90	0.26	23238.30	829.06	1360.09
61	10917.00	794.95	488.17	936.69	-448.52	0.14	27238.73	790.95	1220.71
62	11902.00	648.01	452.99	867.46	-414.47	0.19	25729.75	642.79	1014.03
63	19221.00	1092.82	862.71	884.00	-21.29	0.29	26026.13	1091.11	1713.80
64	22908.00	1043.63	788.98	971.04	-134.06	0.27	29886.23	1039.43	1548.92
65	10243.00	716.08	545.53	864.44	-318.91	0.17	20167.13	713.51	1236.08
66	12456.00	736.79	674.70	839.37	-164.67	0.23	19625.93	734.92	1286.55
67	10404.00	751.97	408.67	880.47	-471.81	0.16	32627.05	747.73	1076.73
68	17928.00	987.71	736.42	888.20	-151.78	0.27	30048.84	984.72	1463.49
69	11064.00	735.34	569.36	874.55	-304.67	0.18	23057.61	732.34	1205.03

TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EP0	EP1
70	18129.00	943.47	479.28	978.73	-499.45	0.21	44184.14	937.88	1201.89
71	11766.00	608.74	534.80	827.39	-288.59	0.23	19708.30	806.56	1060.13
72	13954.00	863.59	677.93	819.95	-142.13	0.23	22116.70	857.71	1434.10
73	12121.00	600.35	572.82	920.30	-347.48	0.16	26864.56	796.53	1202.24
74	13981.00	859.58	687.94	872.17	-184.33	0.22	25648.85	855.12	1367.99
75	11429.00	637.75	558.14	915.33	-357.19	0.16	26007.29	694.09	1090.44
76	10561.00	652.06	556.13	803.88	-247.75	0.23	19363.75	650.29	1144.29
77	10655.00	779.92	574.33	889.20	-314.87	0.16	27598.06	775.64	1191.08
78	11226.00	754.14	657.81	839.79	-181.99	0.20	18499.36	752.07	1346.82
79	10112.00	1014.07	366.87	1084.61	-717.73	0.16	55129.04	1006.68	1154.85
80	14427.00	873.59	619.76	830.48	-210.72	0.27	20677.66	872.03	1352.77
81	18726.00	1011.74	517.76	923.02	-405.26	0.25	39895.91	1007.22	1342.40
82	9032.00	768.63	519.32	870.16	-350.84	0.15	24568.85	765.53	1229.28
83	10774.00	736.83	544.44	838.45	-294.00	0.20	24920.71	724.24	1156.64
84	19660.00	1233.44	661.95	1052.99	-391.02	0.19	40037.47	1226.89	1632.95
85	9537.00	812.18	610.35	823.55	-213.19	0.19	20453.70	810.56	1376.61
86	11497.00	945.08	610.93	916.60	-305.68	0.16	30194.38	941.10	1379.55
87	13513.00	791.25	393.02	914.98	-521.96	0.18	35352.37	787.10	1046.93
88	11687.00	710.21	637.76	845.11	-207.33	0.21	21968.97	708.07	1186.96
89	10449.00	726.27	627.82	834.11	-206.29	0.20	19473.53	784.49	1377.45
90	13269.00	841.69	811.66	792.68	18.99	0.30	18131.94	841.93	1519.43
91	13811.00	849.03	596.26	866.50	-270.24	0.23	26213.54	846.31	1325.56
92	10956.00	771.01	849.10	772.29	76.81	0.26	11502.50	772.36	1660.33
93	10871.00	740.51	457.93	828.86	-370.94	0.20	29055.84	737.94	1110.98
94	12942.00	812.68	76.70	856.35	-779.65	0.21	75463.56	805.81	840.60
95	11645.00	643.14	636.76	801.78	-165.02	0.25	18119.71	681.69	1230.56
96	11730.00	861.40	591.31	851.82	-260.51	0.20	25308.96	808.51	1416.58
97	10888.00	808.56	273.68	834.11	-560.43	0.25	52503.13	803.78	963.91
98	12111.00	915.67	598.96	892.75	-293.78	0.18	27727.69	912.14	1398.15
99	13059.00	830.11	775.58	832.75	-57.17	0.25	17587.95	836.95	1528.23
100	14382.00	812.76	672.19	849.09	-177.80	0.26	25710.89	811.43	1240.42
101	11054.00	834.98	652.20	882.17	-229.97	0.17	26314.43	831.77	1300.96
102	11226.00	791.05	685.31	796.95	-111.64	0.25	16237.20	750.31	1412.76
103	10777.00	690.38	478.72	892.55	-413.83	0.16	35590.63	886.29	1234.23
104	12322.00	782.41	513.34	828.67	-315.33	0.24	33016.41	779.66	1117.53
105	14731.00	795.83	667.63	799.04	-131.41	0.33	21256.44	795.02	1349.71
106	12660.00	879.50	726.25	818.69	-92.44	0.25	23401.58	878.85	1437.89

TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EP0	EP1
107	16481.00	1005.00	917.55	849.58	67.98	0.29	20339.50	1004.16	1733.90
108	13708.00	768.46	630.25	840.17	-209.94	0.26	23018.04	766.40	1261.91
109	11698.00	746.76	349.03	811.82	-462.79	0.24	47097.09	743.07	929.15
110	10265.00	756.48	554.18	917.16	-362.98	0.14	24617.44	752.73	1207.80
111	11326.00	638.00	391.53	935.24	-543.65	0.15	30884.84	603.91	1005.76
112	12030.00	744.60	654.67	845.19	-190.51	0.21	19506.79	742.55	1302.95
113	10358.00	797.38	567.71	857.49	-289.78	0.13	21432.23	764.58	1327.78
114	13612.00	857.81	604.49	881.31	-276.82	0.21	30293.67	854.49	1255.98
115	12198.00	711.40	669.58	804.28	-134.61	0.26	16990.35	710.20	1314.13
116	16385.00	887.81	-0.00	842.99	-842.99	0.33	84236.13	879.49	879.49
117	17819.00	1109.13	707.20	959.44	-252.24	0.21	36191.84	1104.43	1528.14
118	10923.00	759.87	545.91	845.12	-299.21	0.19	30130.91	756.95	1123.79
119	10531.00	691.15	522.50	898.24	-375.74	0.15	23349.13	687.78	1126.25
120	12444.00	675.53	722.34	792.77	-70.43	0.29	13011.01	674.41	1382.70
121	13814.00	834.12	523.98	882.03	-358.05	0.21	32063.72	830.57	1203.97
122	14479.00	958.52	690.30	850.26	-159.96	0.25	26174.79	956.78	1409.44
123	12192.00	801.95	398.70	891.35	-492.65	0.16	34886.41	797.93	1119.76
124	9577.00	715.04	366.37	784.39	-418.02	0.23	35847.89	712.41	989.35
125	12033.00	1008.85	508.66	926.78	-418.11	0.16	37938.50	1004.34	1364.69
126	15784.00	1123.09	848.97	883.90	-34.92	0.30	26268.61	1121.69	1755.46
127	10227.00	655.72	316.31	923.79	-607.49	0.14	40558.84	651.36	882.64
128	23371.00	1208.46	640.31	1065.99	-425.67	0.22	43958.95	1256.37	1613.19
129	13583.00	913.58	704.62	841.55	-136.92	0.25	23205.50	912.34	1497.52
130	11596.00	774.57	610.78	839.74	-228.76	0.21	21222.89	772.35	1312.01
131	12467.00	851.72	769.71	801.54	-31.83	0.27	18301.06	851.41	1531.06
132	20493.00	1409.74	791.99	1108.33	-316.34	0.26	41233.38	1402.21	1845.30
133	12024.00	850.73	346.42	863.50	-517.08	0.20	42093.75	845.65	1105.33
134	14465.00	1018.78	632.93	910.39	-277.94	0.27	36128.87	1014.59	1404.76
135	12712.00	892.10	538.35	830.27	-291.92	0.24	26875.61	889.55	1069.72
136	11722.00	754.54	446.69	801.30	-354.61	0.25	21245.64	753.32	1279.17
137	14968.00	873.68	743.96	831.46	-82.50	0.23	22909.59	872.33	1438.93
138	12204.00	787.22	579.01	786.59	-207.58	0.29	24386.48	786.36	1256.34
139	13378.00	1068.68	659.45	943.00	-283.55	0.24	35219.39	1064.29	1488.09
140	12464.00	720.84	583.62	909.21	-315.60	0.17	24766.06	717.18	1148.10
141	12509.00	833.14	667.84	834.04	-166.20	0.23	21996.65	821.47	1376.39
142	11321.00	942.56	665.80	902.29	-236.49	0.16	21087.96	939.62	1600.09
143	10347.00	813.93	320.71	789.83	-469.12	0.24	47444.09	810.62	1010.76

Table 28

Distribution of Gains by Town Characteristics

Plan 2b

Equation (27.1):

$$\underset{(3.11)}{\text{GAIN 22} = -231.7} \underset{(1.02)}{- 0.0058\ \text{MENINC}}$$

$R^2 = .0081 \quad F(1,128) = 1.040$

Equation (27.2):

$$\underset{(3.09)}{\text{GAIN 22} = 71.81} \underset{(17.70)}{- 0.0135\ \text{TAXSTD}}$$

$R^2 = .7099 \quad F(1,128) = 313.171$

Equation (27.3):

$$\underset{(3.06)}{\text{GAIN 22} = -109.9} \underset{(6.14)}{+ 0.0180\ \text{MENINC}} \underset{(20.89)}{- 0.0153\ \text{TAXSTD}}$$

$R^2 = .7763 \quad F(2.127) = 220.397$

Equation (27.4):

$$\underset{(0.67)}{\text{GAIN 22} = 59.43} \underset{(4.18)}{- 0.4297\ \text{EXPRST}}$$

$R^2 = .1201 \quad F(1,128) = 17.475$

Equation (27.5):

$$\underset{(2.21)}{\text{GAIN 22} = -102.3} \underset{(5.18)}{+ 0.0186\ \text{MENINC}} \underset{(18.76)}{- 0.0152\ \text{TAXSTD}} \underset{(0.26)}{- 0.0200\ \text{EXPRST}}$$

$R^2 = .7765 \quad F(3,126) = 145.878$

Equation (27.6):

$$\underset{(9.86)}{\text{GAIN 22} = -313.8} \underset{(1.68)}{+ 0.0041\ \text{MENINC}} \underset{(21.56)}{- 0.0125\ \text{TAXSTD}} \underset{(10.97)}{+ 1488.6\ \text{BURDEN}}$$

$R^2 = .8856 \quad F(3,126) = 325.227$

Table 29.

Effect of Plan 2b on Expenditures

by Town Characteristic

EXP 2b = Expenditures under Plan 2b

Equation (28.1):

$$\underset{}{\text{EXP 2b}} = \underset{(7.83)}{675.2} + \underset{(7.73)}{0.7713}\ \text{EXPRST}$$

$$R^2 = .3183 \qquad F(1,128) = 59.770$$

Equation (28.2):

$$\underset{}{\text{EXP 2b}} = \underset{(10.73)}{498.7} + \underset{(24.92)}{1.5544}\ \text{EXPRST} + \underset{(1.91)}{297.75}\ \text{BURDEN}$$

$$- \underset{(2.61)}{0.0090}\ \text{MENINC} - \underset{(24.49)}{0.0156}\ \text{TAXSTD}$$

$$R^2 = .8956 \qquad F(4,125) = 268.185$$

TABLE 30

TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EP0	EP1
1	12450.00	858.99	585.67	410.37	175.30	0.24	17125.12	860.52	1242.56
2	16339.00	687.54	332.74	397.56	-64.82	0.30	22115.79	687.65	866.98
3	10191.00	748.00	367.25	374.44	-7.20	0.17	24225.85	748.12	978.25
4	11929.00	688.74	160.73	398.73	-238.00	0.22	30374.57	687.70	765.90
5	10400.00	818.78	488.27	382.52	105.75	0.18	19683.05	817.56	1152.52
6	14004.00	937.36	101.48	168.15	-66.67	0.12	39738.01	834.93	888.75
7	16596.00	1048.49	169.83	355.89	-186.05	0.25	32963.15	1047.01	1154.40
8	13336.00	936.45	150.76	300.00	-149.24	0.17	38985.36	934.48	1009.62
9	10598.00	634.24	333.83	414.43	-80.60	0.21	16529.87	635.30	894.29
10	12066.00	835.46	581.18	391.78	189.39	0.21	8992.67	837.45	1426.86
11	12152.00	955.05	479.45	412.94	66.51	0.24	20279.70	855.96	1139.13
12	11806.00	932.16	122.37	425.98	-303.61	0.24	57139.52	930.21	900.17
13	15426.00	1001.25	247.33	400.79	-153.45	0.28	25029.09	1001.86	1172.68
14	11448.00	622.43	521.38	428.79	92.59	0.24	12655.04	626.26	1022.98
15	17133.00	898.13	134.45	228.75	-94.30	0.17	51195.40	895.60	958.33
16	12966.00	727.76	270.08	366.73	-96.65	0.21	28084.45	727.18	875.05
17	11765.00	665.99	482.99	451.31	31.68	0.29	13140.88	670.03	996.19
18	10772.00	935.24	476.46	316.85	159.61	0.14	21246.54	935.22	1323.97
19	9623.00	850.85	195.25	494.26	-299.02	0.32	22736.77	852.98	1040.32
20	13994.00	844.58	197.15	401.55	-204.41	0.26	31074.77	843.38	943.11
21	11675.00	808.33	494.39	428.22	66.16	0.25	16159.41	809.85	1121.03
22	11169.00	796.37	445.19	411.82	33.37	0.22	17708.75	797.41	1088.27
23	19988.00	1470.93	120.52	-78.74	199.26	0.11	81493.50	1466.55	1561.09
24	13632.00	896.13	199.42	451.14	-251.72	0.33	29043.95	895.58	1008.50
25	12012.00	1327.84	90.34	137.94	-47.60	0.10	51133.41	1324.20	1409.56
26	15038.00	912.18	126.46	352.34	-225.88	0.22	40037.38	909.91	968.56
27	14672.00	757.74	558.23	405.84	152.39	0.28	15752.47	769.05	1114.93
28	9832.00	798.78	511.80	371.21	140.59	0.16	16701.11	799.68	1189.93
29	10528.00	620.63	380.87	387.98	-7.11	0.18	17630.51	621.53	921.01
30	11005.00	795.13	413.67	311.24	102.43	0.14	26014.65	794.94	1098.52
31	21563.00	1107.51	116.26	316.11	-199.85	0.28	35720.26	1104.97	1176.20
32	13136.00	838.67	346.11	368.76	-22.65	0.21	28146.68	838.02	1073.23

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TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EP0	EP1
33	11690.00	730.47	637.97	409.37	228.61	0.22	10584.59	732.52	1225.70
34	14279.00	720.79	97.70	369.72	-272.02	0.23	39100.75	719.05	765.40
35	11909.00	793.11	542.05	418.66	123.39	0.24	16993.06	794.65	1138.25
36	11055.00	780.66	292.33	367.12	-74.78	0.18	29792.03	780.09	944.20
37	16592.00	706.75	250.44	385.08	-134.63	0.22	24207.52	706.25	841.55
38	12851.00	739.38	389.92	435.65	-45.83	0.28	19704.38	740.23	950.84
39	10689.00	957.54	103.89	364.32	-260.43	0.17	54413.92	955.57	1017.17
40	10298.00	790.55	377.82	405.10	-27.27	0.19	24825.42	790.75	994.30
41	9050.00	801.42	628.73	350.37	272.36	0.13	9805.40	802.58	1367.44
42	11072.00	845.07	102.74	458.39	-355.65	0.28	43534.92	844.55	899.00
43	10390.00	784.95	340.06	361.72	-21.66	0.16	27182.43	784.73	986.11
44	12741.00	951.72	282.27	408.52	-146.25	0.24	22395.89	951.86	1179.87
45	14262.00	864.26	191.43	376.48	-185.05	0.24	29771.04	862.77	959.08
46	12147.00	813.16	531.49	418.41	113.08	0.24	18495.02	814.62	1149.18
47	10995.00	702.98	532.37	323.18	209.19	0.15	13204.02	700.67	1198.91
48	10971.00	829.37	304.18	406.45	-102.27	0.21	27091.94	829.17	1000.36
49	13664.00	751.27	433.31	402.33	30.98	0.23	16515.59	752.20	1044.58
50	11145.00	792.51	161.56	388.60	-227.04	0.19	33569.39	791.15	874.48
51	13587.00	841.53	457.93	439.09	18.85	0.31	18122.96	842.95	1114.59
52	12198.00	1125.61	313.05	-166.87	479.92	0.06	25959.92	1123.00	1354.94
53	12033.00	764.05	353.17	353.52	39.65	0.18	22834.26	763.94	993.96
54	16546.00	936.60	211.57	385.82	-174.25	0.28	25884.54	934.37	1062.56
55	12093.00	782.12	501.83	408.25	93.59	0.23	20456.95	783.16	1081.40
56	14108.00	815.23	360.11	383.60	-23.49	0.24	23837.44	814.94	1001.06
57	14263.00	950.91	460.92	413.00	47.93	0.28	18182.36	953.97	1310.34
58	10977.00	623.64	256.79	380.02	-123.23	0.17	25318.84	623.74	808.68
59	12388.00	740.43	500.76	403.28	97.48	0.23	16948.30	741.70	1095.11
60	12043.00	829.88	296.45	429.23	-132.78	0.25	23233.30	829.94	994.86
61	10917.00	794.95	363.65	310.76	52.89	0.14	27238.73	794.53	1052.76
62	11902.00	646.01	281.99	373.66	-91.67	0.19	25729.75	645.98	828.71
63	19721.00	1092.82	254.86	358.63	-103.77	0.29	24028.13	1092.23	1263.70
64	22938.00	1043.53	230.98	279.55	-48.56	0.27	29886.23	1042.02	1178.37
65	10243.00	716.08	403.32	376.41	26.92	0.17	20167.13	716.69	1012.14
66	12456.00	736.79	447.76	399.19	48.57	0.23	19625.93	737.51	1052.52
67	10464.00	751.97	197.96	361.84	-163.88	0.16	32827.05	751.08	873.50
68	17929.00	987.71	222.99	354.82	-131.83	0.27	30048.84	986.69	1111.57
69	11084.00	735.34	354.61	367.22	-12.62	0.18	23057.61	735.26	945.82

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TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EPO	EP1
70	18129.00	943.47	122.88	272.56	-149.68	0.21	44184.14	941.17	1001.83
71	11786.00	604.74	337.79	410.07	-72.28	0.23	19708.30	609.38	814.37
72	13954.00	858.59	379.64	416.82	-37.18	0.28	22116.70	859.05	1083.79
73	12101.00	800.36	342.52	325.65	16.87	0.16	28864.55	799.58	984.27
74	13936.00	868.58	327.89	369.39	-41.49	0.22	25648.95	867.92	1034.98
75	11429.00	697.75	402.	370.17	72.65	0.16	26007.29	697.53	925.27
76	10561.00	652.06	343.75	431.43	-87.69	0.23	19363.75	653.09	872.22
77	10855.00	778.92	364.96	353.91	11.06	0.16	27598.05	778.57	982.71
78	11226.00	754.14	472.71	398.80	73.91	0.20	18499.35	755.11	1062.66
79	18112.00	1014.07	125.06	176.36	-51.30	0.16	55129.04	1011.36	1076.55
80	14423.00	873.59	251.98	407.26	-155.28	0.27	26877.66	872.82	1006.32
81	18726.00	1011.74	109.88	323.18	-213.30	0.25	39895.91	1009.46	1074.53
82	9032.00	768.63	395.15	371.21	23.94	0.15	24568.85	768.98	1045.32
83	10774.00	726.83	287.56	400.03	-112.47	0.20	24920.71	726.66	883.65
84	19668.00	1233.44	115.76	205.09	-89.33	0.19	40037.47	1230.21	1309.51
85	9537.00	812.18	406.91	413.56	-6.65	0.19	20453.70	813.11	1068.52
86	11497.00	945.08	277.41	329.01	-51.60	0.16	30194.38	943.58	1089.34
87	13313.00	791.25	172.27	330.48	-158.22	0.18	35352.37	789.81	892.99
88	11687.00	710.21	433.49	393.97	39.52	0.21	21968.97	710.77	957.73
89	10449.00	786.27	452.21	403.96	48.24	0.20	19473.53	787.34	1102.54
90	13069.00	841.69	487.75	441.61	41.14	0.30	13131.94	843.13	1110.01
91	13511.00	849.03	322.15	374.53	-52.38	0.23	26213.54	848.55	1034.36
92	10956.00	771.01	645.34	460.14	185.20	0.28	11502.50	774.53	1238.70
93	10571.00	740.51	196.18	408.73	-212.55	0.20	29059.84	739.85	851.07
94	12592.00	812.68	114.98	383.76	-268.78	0.21	75463.56	810.77	863.03
95	11645.00	683.14	406.90	433.34	-26.44	0.25	18119.71	684.39	928.91
96	11730.00	891.40	382.28	387.87	-5.59	0.20	25308.96	891.40	1124.47
97	10884.00	805.59	109.17	403.96	-294.79	0.20	52508.13	805.78	858.78
98	12111.00	915.57	327.30	350.69	-23.39	0.18	27727.69	914.72	1104.84
99	13059.00	838.11	533.78	405.20	128.58	0.25	17587.95	839.28	1176.21
100	14823.00	813.76	318.74	389.53	-70.79	0.26	25710.89	813.22	967.39
101	11064.00	834.98	354.39	360.30	-5.91	0.17	26314.43	834.35	1014.94
102	11226.00	751.05	524.02	437.73	86.29	0.25	16237.20	753.25	1121.79
103	10777.00	890.38	235.33	350.86	-115.53	0.16	35590.63	889.03	1018.88
104	12322.00	782.41	131.71	408.91	-277.20	0.24	33016.41	780.83	839.82
105	14731.00	795.83	348.96	435.83	-86.87	0.33	21256.44	796.41	987.72
106	12660.00	879.50	370.22	417.98	-47.75	0.25	23401.58	879.64	1076.65

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TOWN	INCOME	INITIAL SPENDING	BENEFIT	COST	NET GAIN	STUDENTS PER CAP	TAX BASE PER STUDENT	EP0	EP1
107	16481.00	1005.00	385.14	389.91	-4.77	0.29	20339.50	1004.51	1282.52
108	13709.00	768.46	348.95	398.46	-49.51	0.25	23018.04	768.52	960.76
109	11650.00	746.76	112.56	424.22	-311.66	0.24	47097.09	745.19	793.22
110	10265.00	756.46	420.16	328.51	91.65	0.14	24517.44	756.33	1025.45
111	11326.00	696.00	270.58	312.08	-41.50	0.15	30864.84	697.42	871.72
112	12030.00	744.60	405.[illegible]	[illegible]3.90	12.04	0.21	19508.79	745.06	986.40
113	10359.00	787.38	429.84	382.72	47.12	0.18	21432.23	788.01	1090.33
114	13612.00	857.81	314.24	361.08	-46.84	0.21	30292.67	856.93	1015.88
115	12156.00	711.40	447.56	431.07	16.50	0.26	16990.35	712.82	989.44
116	19385.00	887.81	130.07	395.90	-265.83	0.33	84236.13	885.78	942.88
117	17819.00	1100.13	124.47	290.09	-165.62	0.21	36191.84	1106.48	1177.81
118	10923.00	759.87	299.10	393.96	-94.86	0.19	30130.91	759.47	909.34
119	10531.00	691.15	390.68	345.70	44.99	0.15	23349.13	692.22	954.36
120	12444.00	675.53	516.59	441.53	75.06	0.29	13011.01	679.50	1041.05
121	13819.00	834.12	199.99	360.43	-160.43	0.21	32063.72	832.68	933.61
122	14479.00	958.52	272.31	389.29	-116.98	0.25	26174.79	958.94	1144.24
123	12192.00	801.95	99.00	351.95	-252.95	0.18	34895.41	799.99	854.63
124	9577.00	715.04	73.53	449.14	-375.61	0.23	35847.89	713.69	759.69
125	12039.00	1008.85	102.89	319.78	-216.89	0.16	37936.50	1006.56	1071.44
126	19784.00	1123.09	249.01	358.73	-109.72	0.30	26268.61	1122.54	1302.29
127	10227.00	655.72	158.88	322.48	-163.59	0.14	40558.84	654.58	748.66
128	23271.00	1268.46	121.77	193.28	-71.51	0.22	43956.85	1260.12	1341.35
129	13863.00	913.58	288.44	397.21	-108.77	0.25	23205.50	914.32	1105.17
130	11598.00	774.57	400.16	398.85	1.32	0.21	21222.89	775.11	1025.48
131	12467.00	851.72	520.25	433.56	86.69	0.27	18301.06	853.40	1172.27
132	30693.00	1409.74	125.13	154.81	-29.69	0.20	41233.33	1405.91	1496.54
133	12024.00	850.73	96.55	377.26	-280.71	0.20	42098.75	848.70	903.41
134	19465.00	1018.78	121.09	334.20	-213.12	0.27	36128.87	1016.53	1032.06
135	12712.00	692.10	276.27	407.46	-131.18	0.24	26875.61	691.90	831.10
136	11722.00	754.54	254.68	433.78	-179.10	0.26	21245.64	755.29	958.20
137	14968.00	873.68	297.89	406.38	-8.48	0.28	22909.59	873.75	1090.60
138	12204.00	787.22	270.47	447.15	-176.68	0.29	24386.48	787.47	935.97
139	19378.00	1062.68	122.93	305.02	-182.10	0.24	35219.39	1066.19	1134.92
140	12459.00	720.84	365.19	335.73	29.47	0.17	24766.06	720.39	912.89
141	12505.00	823.14	393.77	404.03	-10.26	0.23	21996.65	823.50	1053.34
142	11321.00	942.56	483.21	342.02	141.19	0.16	21087.96	942.68	1300.40
143	10347.00	813.93	104.88	444.20	-339.32	0.24	47444.09	812.35	864.72

Table 31 shows that the relationship between gains and town income is the same mildly redistributive relation that exists for the other plans, with the exception that the breakeven level for Plan 3 is $9,272. Welfare gains are completely uncorrelated with current expenditure. Finally, equation (31.6) shows that the gains from Plan 3 are negatively related to the student-population ratio, holding wealth and income constant. The reason for this result is that state expenditure under Plan 3 is lower than state expenditure under a minimum foundation plan. The resulting lower state share of financing helps those towns with a lower student-population ratio.

Finally, Table 32 shows the correlation between gains under all five plans with each other and with city size. Although the gains from power-equalizing are not correlated with city size, power-equalizing leaves cities in a worse position in absolute terms, since the average community suffers a net loss. The Massachusetts Plan helps cities relative to small towns because of the provision that the aid ratio be based on wealth per student, rather than wealth per public school student. In Massachusetts, the big cities, with their large numbers of Catholics and high incidence of families on welfare, have relatively more private school pupils than the suburbs and small towns.

In conclusion, all the plans with the exception of Plan 3 leave almost all of the towns and cities worse off, and, in general, reduce the welfare of residents of low-income communities and big cities. Low-income residents suffer because the relative per-student wealth in the communities in which they reside is not sufficiently low to entitle them to benefits large enough to outweigh the

Table 31.

Distribution of Gains by Characteristics

Plan 3

Equation (31.1):

GAIN 3 = 95.50 - 0.0103 MENINC
(1.79) (2.55)

R^2 = .0482 F(1,128) = 6.485

Equation (31.2):

GAIN 3 = 127.5 - 0.0059 TAXSTD
(4.68) (6.56)

R^2 = .2516 F(1,128) = 43.022

Equation (31.3):

GAIN 3 = 141.4 - 0.0014 MENINC - 0.0057 TAXSTD
(2.94) (0.35) (5.89)

R^2 = .2523 F(2,127) = 21.425

Equation (31.4):

GAIN 3 = -27.45 - 0.0108 EXPRST
(0.40) (0.14)

R^2 = .0001 F(1,128) = 0.018

Equation (31.5):

GAIN 3 = -59.84 - 0.0156 MENINC + 0.5283 EXPRST - 0.0081 TAXSTD
(1.09) (3.67) (5.88) (8.48)

R^2 = .4131 F(3,126) = 29.568

Equation (31.6):

GAIN 3 = 386.5 + 0.0154 MENINC - 0.0090 TAXSTD - 1789.6 BURDEN
(8.37) (4.30) (10.71) (9.09)

R^2 = .5482 F(3,126) = 50.970

Table 32

Correlation Matrix of Gains for All Five Plans with Population Size

	Gain 1a	Gain 1b	Gain 2a	Gain 2b	Gain 3	People
Gain 1a	1.000	0.7419	0.5065	0.6711	-0.1383	-0.2791
Gain 1b	0.7419	1.0000	0.3999	0.6243	-0.2892	-0.3303
Gain 2a	0.5065	0.3999	1.0000	0.9429	0.4702	0.0425
Gain 2b	0.6711	0.6243	0.9429	1.0000	0.2421	-0.0718
Gain 3	-0.1383	-0.2892	0.4702	0.2421	1.0000	0.3259
People	-0.2791	-0.3303	0.0425	-0.0718	0.3259	1.0000

efficiency losses caused by the distortion of their preferences. Residents of cities suffer losses because, in general, cities have an advantage in financing public education in a system based on local effort. The low student to population ratio and the high proportion of business property makes the price of public education per capita lower in cities than outside of cities. One explanation of the urban crisis is that the migration of industry and wealthy residents away from the city has damaged the ability of cities to finance public services, especially education, which in turn has induced further out-migration of the wealthy.[1] While the change in cities' position has been detrimental, the central cities still retain a fiscal advantage in financing education. Increasing aid to cities may still be desireable and the educational finance system is one way of providing that aid. Yet, the results here do show that reliance on local finance of education is more favorable to cities than either statewide financing or power-equalizing.

Finally, two sources of possible bias in the estimates of this section are worth recalling. First, true price elasticity may be greater in absolute terms than the estimate used here. If this is the case, tnen the losses from statewide financing are exaggerated while the losses from power-equalizing are underestimated. Second, the appropriate alternative foundation plan may be one in which localities are required to impose on themselves a minimum tax effort. Use of the flat grant foundation plan is less favorable to cities than the alternative.

[1] See Bradford and Kelejian (1973).

Hence, using the alternative as the base plan would make the losses to cities from the reform plans even greater than the losses measured here.

VI. Conclusions

Variations in educational expenditure among local towns and cities in Massachusetts are explained well by variations in income and the price of education. The best estimates of the income and price elasticities of demand for education are in the neighborhood of 0.6 and -0.4. It is likely that the absolute value of the price elasticity is biased downwards. Private school enrollment appears to be unaffected by changes in expenditure on public education. Further, the net effect of an incraesed propensity to attend private schools on public school expenditure also appears to be negligible.

Applying the standard techniques of welfare economics and benefit-cost analysis with the best estimates of the demand equation for education, it is found that the costs outweigh the benefits for most of the reform plans considered. Statewide financing and power-equalizing appear to reduce welfare for almost all towns and do not provide net benefits to low-income communities or to cities. The current Massachusetts Plan, if fully financed with its current legal restrictions, redistributes welfare only slightly with a very small net loss and improves the welfare of residents of the largest central cities.

The methods used here can be used to estimate the gains and losses by town and/or income group for other educational finance plans, or for different variants of the plans analyzed here.

The results of this study would be improved if more confidence could be placed in the estimate of the price elasticity of demand for public education. Further research in this area, perhaps using data from other states, would be useful. The results do indicate a need for great caution in adopting reform plans which purport to redistribute educational expenditure. As demonstrated here, it is quite within the realm of possibility that such plans may reduce the welfare of all segments of the population.

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Appendix: Construction of Variables

This Appendix provides further explanation of the construction of some of the variables which were defined in Table 2.

1) LSBLOC2:

LSBLOC2 is the portion of Chapter 70 aid which a district can treat as untied additional income. If the district is spending less than 110 percent of average reimbursable expenditures in the state, LSBLOC2 is equal to the product of the matching rate for the district and 80 percent of average reimbursable expenditures. The matching rate is a function of the district's wealth per student. All districts will receive matching aid based on at least eight percent of reimbursable expenditures, according to the Massachusetts laws. If the district is spending more than 110 percent of the average reimbursable expenditures, then the product of the matching rate and 110 percent of expenditures is the lump-sum component of aid.

2) SEACAP:

SEACAP is the value of seasonal homes per capita. It is computed by multiplying the number of seasonal units in a district by the median value of homes in the district, and then dividing by population. Direct data giving the value of the seasonal units themselves does not exist. The source of the housing data is the U.S. Census of Housing for Massachusetts.

3) BUSCAP:

BUSCAP is a crude estimate of the value of business

per capita. It was calculated in the following manner. First, a value of business figure for the entire state was supplied by Massachusetts Taxpayers, and the ratio of business value to total state employment was computed. Then, it was assumed that the ratio of business property value to employment was the same in every town. The employment figures (source: U.S. Census) measure number of people employed in enterprises in the town, not number of local residents employed. The computed business value figures are then divided by population to obtain business value per capita.

4) PCRES:

PCRES was calculated using the formula:

$$PCRES = \frac{AVALUE + HVALUE}{AVALUE + HVALUE + SVALUE + BVALUE} \qquad (A.1)$$

where AVALUE = value of apartments, HVALUE = value of owner-occupied homes, SVALUE = value of seasonal homes, and BVALUE = estimated value of business property. If seasonal homes and business property are all owned by residents of other communities, PCRES as computed in (A.1) provides an estimate of the fraction of property owned by local residents. SVALUE and BVALUE are computed as described above. AVALUE is computed by multiplying the annual rental of all apartments estimated from Census data by five. (It is assumed that annual rental of an apartment is, on the average, equal to one-fifth of the value of the apartment.) HVALUE is obtained

directly from the Census by dividing the value of homes measured by the fraction of homes used to compute the Census figure.

PCRES is thus a crude measure of percent of property owned by residents. However, PCRES, SEACAP and BUSCAP have significant coefficients and the theoretically correct signs in the regression equations. The coefficient of PCRES in Equation (5.4) should only be thought of as the coefficient of the measured variable used here. But it is legitimate to used the estimated coefficient in combination with the estimated price elasticity to infer the effect of measured PCRES on the price of education.

5) RESASS:

RESASS is another series measuring the percent of property owned by residents. It was supplied to the author by Andre Daniere and comes from data collected in the Governor's office in Massachusetts. RESASS does not work as well in the regressions as PCRES. There are two possible reasons for this:

i) Under Massachusetts law, the tax rates imposed on business and residential property must be the same. Towns that wish to make the effective rates different can do so by using different assessment ratios for different kinds of property. While the state figures on total property value are supposed to adjust for differences in average assessment ratio across towns, the figures on the fraction of assessed value from one type of property may be a poor measure of the fraction of actual value of that property. The latter is the relevant variable.

ii) Even if accurate figures for business value were available, it is possible that the employment figure is a better measure of the "exploitability" of local businesses. The value of business is itself sensitive to tax rates for educational expenditures even if businesses don't move.